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ARCHITECTURE

CREATION OF INNOVATION WITH INNOVATIVE TECHNOLOGIES FOR THE FIRST TIME IN THE CONDITIONS OF NAKHCHIVAN AUTONOMOUS REPUBLIC

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SCHAFFUNG VON INNOVATIONEN DURCH INNOVATIVE TECHNOLOGIEN – ERSTMALS UNTER DEN BEDINGUNGEN DER AUTONOMEN REPUBLIK NACHITSCHEWAN

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Abstract

One of the priority directions of agriculture is the intensive development of horticulture and fruit growing. At this stage of development, the production of healthy, certified and genetically stable planting material is of great importance for the establishment of gardens with high productivity and longevity. Especially in intensive horticultural systems, the organization of the field of horticulture on a scientific basis plays a strategically important role in increasing productivity indicators and ensuring the sustainability of production. Innovative ways applied to each sector in the development of the agricultural sector stimulate more intensive and rapid development by increasing productivity and quality.

In this context, on 05.12.2025, for the first time in the Nakhchivan Autonomous Republic, with the application of innovative technologies, cultivation fields and a collection orchard were established in the city of Nakhchivan and Sharur Base of the Nakhchivan Scientific-Research Institute of Agriculture named after Academician Hasan Aliyev.

The main purpose of the study is to create a collection garden consisting of fruit varieties that can be adapted to the climatic conditions of the region in order to develop horticulture in the conditions of the autonomous republic. For this purpose, it is the development of intensive horticulture in accordance with the principles of market relations, the determination of priority directions and the study of efficiency with scientific foundations.

Zusammenfassung

Eine der Prioritäten der Landwirtschaft ist die intensive Entwicklung des Gartenbaus und des Obstanbaus. In dieser Entwicklungsphase ist die Produktion von gesundem, zertifiziertem und genetisch stabilem Pflanzgut von großer Bedeutung für die Anlage ertragreicher und langlebiger Gärten. Insbesondere in intensiven Gartenbausystemen spielt die wissenschaftliche Organisation der Anbauflächen eine strategisch wichtige Rolle für die Steigerung der Produktivität und die Sicherung der Nachhaltigkeit der Produktion. Innovative Ansätze in den einzelnen Sektoren der Landwirtschaft fördern eine intensivere und schnellere Entwicklung durch Steigerung von Produktivität und Qualität.

In diesem Zusammenhang wurden am 5. Dezember 2025 in der Autonomen Republik Nachitschewan erstmals Anbauflächen und eine Obstgartenanlage unter Anwendung innovativer Technologien in der Stadt Nachitschewan und auf dem Scharur-Gelände des nach Akademiemitglied Hasan Alijew benannten Wissenschaftlichen Forschungsinstituts für Landwirtschaft in Nachitschewan angelegt.

Hauptziel der Studie ist die Anlage eines Sammelgartens mit Obstsorten, die an die klimatischen Bedingungen der Region angepasst sind, um den Gartenbau in der autonomen Republik zu fördern. Dazu soll ein intensiver Gartenbau nach marktwirtschaftlichen Prinzipien entwickelt, Prioritäten gesetzt und die Effizienz wissenschaftlich fundiert untersucht werden.

Keywords: Innovative technologies, agriculture, agricultural sector, fruit growing, climate.
Schlüsselwörter: Innovative Technologien, Landwirtschaft, Agrarsektor, Obstanbau, Klima.

The modernization of agriculture and the efficient use of the agricultural potential of the regions are among the main directions of modern economic development strategies. The Nakhchivan Autonomous Republic is distinguished by its specific geographical position and continental climate characteristics. The high solar radiation in the region, the length of the vegetation period, and soil diversity create favorable opportunities for the development of fruit growing. However, the scarcity of precipitation and the limitation of water resources require the application of intensive and scientifically based nursery systems.A high-intensity cultivation system is an agricultural production model based

on the principles of dense plant placement and optimal use of soil, water, nutrients, light, and labor resources.

Innovative technology development in the agricultural sector serves as the main driving force of structural changes in world economies. Technology has also significantly affected the green industry, strengthening the development, production, and marketing of nursery plants. Intensive nursery production is a system aimed at the production of high-quality, certified planting material, which forms the basis of modern horticulture. When this system is integrated with innovative technologies, it leads to the structural transformation of the agricultural sector. [2, s. 2-3]

Intensive nursery production involves the production of genetically pure, disease-free, and high-yield potential planting material in a short period. This system includes the organization of certified mother orchards, optimization of vegetative propagation methods, use of modern substrate and container technologies, drip irrigation and fertigation systems, and phytosanitary monitoring and laboratory diagnostics. [6, s. 14-26].

Under the conditions of the Nakhchivan Autonomous Republic, the application of an intensive nursery system serves to ensure stable production by minimizing the region's climatic risks. For this reason, the limited availability of water resources makes the implementation of water-saving technologies a priority direction.Drip irrigation systems ensure the direct delivery of water to the root zone and minimize evaporation losses [3, pp. 6–7]. Through the fertigation method, the precise application of nutrients creates conditions for balanced plant nutrition. Thus, this approach reduces water consumption by 30–50%, minimizes mineral fertilizer losses, and at the same time contributes to the preservation of soil structure [7, pp. 191–198].

It has been established that the application of innovative technologies has a significant impact on increasing productivity, producing genetically healthy planting material, and enhancing the competitiveness of the agrarian sector in the region. In our republic, special attention is paid to the development of fruit growing. While the productivity of old-type orchards does not exceed 70–80 centners per hectare, the productivity of orchards established using innovative technologies in accordance with modern agrotechnical requirements reaches 300–400 c/ha [4, pp. 4–5]. For this reason, the development of fruit growing in the region, especially the industrial-scale cultivation of species such as apple, pear, apricot, peach, cherry, and walnut, necessitates the organization of high-quality and certified nursery production. The application of innovative technologies not only increases the efficiency of intensive nursery farms but also creates a basis for ensuring phytosanitary safety and producing export-oriented products.

The main determinant of structural and functional changes in the nursery sector is technological innovation, which in modern production systems is aimed not only at increasing quantitative indicators but also at optimizing quality parameters, ensuring efficient use of resources, and maintaining ecological sustainability [5, pp 7-8.].

Research object and subject. The establishment of intensive-type nursery areas under the soil and climatic conditions of the Nakhchivan Autonomous Republic.

Research purpose and objectives. The main purpose of the research is to establish nurseries consisting of fruit varieties adaptable to the climatic conditions of the region for the development of horticulture under the conditions of the autonomous republic. In the research object, studies are conducted on intensive nursery production (based on new varieties) through the application of innovative technologies. In this regard, the following tasks are carried out in the research:

- Increasing the development and efficiency of intensive horticulture in accordance with the principles of market relations;
- Studying fruit growing and nursery production on scientific bases through the application of innovative technologies;
- Comparing the regional development characteristics of nursery farms and determining priority directions.

Research method. In the research process, the establishment of modern nursery production under the soil and climatic conditions of the region, the introduction of adaptable varieties, and the study of their comparative characteristics are carried oout

Experimental Part: Soil analyses of the research object were analyzed in the general analytical analysis laboratory of the Research Institute of Fruit-Growing and Tea-Growing of the Ministry of Agriculture of the Republic of Azerbaijan (Table 1).

Table 1

General soil analysis of the research object

Soil layer, cm	Name of indicator	Unit of measurement	Analysis result	Evaluation	Norm	Reference method
0-30	Nitrogen	%	0.11	medium	0.09-0.17	Kjeldahl
	Phosphorus	mg/kg	18	low	24-48	Olsen
	Lime	%	18.6	very limy	5-15	Scheibler Calcimeter
	Humus	%	1.9	low	2-3	Walkley Black
	pH	%	8.2	weak alkaline	6.6-7.5	Saturation pH meter
	Mechanical composition	%	40, 20, 40	sand, clay, silt		Hydrometric method
	Electrical conductivity	m/siemens	317	non-saline	0-2000	EC
30-60	Nitrogen	%	0.10	medium	0.09-0.17	Kjeldahl
	Phosphorus	mg/kg	9	very low	24-48	Olsen
	Lime	%	18.3	very limy	5-15	Scheibler Calcimeter
	Humus	%	1.5	low	2-3	Walkley Black
	pH	%	8.1	weak alkaline	6.6-7.5	Saturation pH meter
	Mechanical composition	%	38, 16, 46	sand, clay, silt		Hydrometric method
	Electrical conductivity	m/siemens	320	non-saline	0-2000	EC

The results of the conducted agrochemical analyses have shown that the selected areas are suitable for the establishment of intensive nursery and fruit-growing farms in terms of the soil's mechanical composition, level of provision with nutrients, water-physical properties, and climatic indicators. At the same time, the adaptation potential of the introduced varieties, their vegetative development indicators, and initial phenological observations provide a basis for achieving high results through their adaptation to the soil-climatic conditions of the region.

For the first time in the Autonomous Republic, nursery areas have been established through the application of innovative technologies (on 05.12.2025 at the Nakhchivan city and Sharur Support Station of the Nakhchivan Agricultural Scientific Research Institute named after Academician Hasan Aliyev). Planting materials were obtained within the framework of cooperation from the Fruit Growing and Tea Growing Scientific Research Institute of the Ministry of Agriculture of the Republic of Azerbaijan.

In the newly established 1 ha nursery areas, 50 thousand rootstocks of foreign origin, including VSL 2, Gizella 6, Garnem 15, Adara, and Myrobolan 29-C varieties, have been planted. The nursery has been provided with an irrigation system in accordance with innovative technologies (Table 2), (Figure 1)

Table 2

Characteristics of the Studied Varieties

Variety Name	Origin	Field of use	Soil Compatibility	Yielding	Climate Resistance	Planting Scheme	Number
VSL 2	Lannesiana cherry x steppe cherry	Sweat cherry, sour cherry	Heavy moist, clayey Soils	Yields in the 3rd year	Resistant to cold, heat, drought	5x2.5m	1800 units
Gizella 6	Prunus cerasus x Prunus canesce	Sweet cherry, sour cherry	Deep and irrigated soils	Yield early	Resistant to winter, cold	3x1m	10000 Units
Garnem 15	Prunus dulcis x Prunus persica	Peach, nectarine, almont, apricot	Heavy clayey, and limy soils	Yields in the 2nd-3rd year	Resistant to cold, heat, drought	5x3.5m	8000 Units
Adara	Prunus cerasifera x Prunus dulcis	Sweet cherry, peach, sour cherry	Clayey, well-drained soils	Early and abundant yield	Cold resistant	4.5x2.5m	3,500 Units
Myrobolan 29-C	Prunus cerasifera	Plum, apricot, cherry plum	Heavy clayey, high and medium drained soils	Yields early and abundantly	Moderately drought resistnce	5x4m	10500 Units

Figure 1. Newly established nursery

Conclusion

It should be noted that the creation of opportunities for the correct and efficient use of sustainable development resources in important areas of agriculture using innovative technologies is of great importance.

Conducted research shows that the application of innovative technologies for intensive nursery production in the conditions of the Nakhchivan Autonomous Republic is efficient from agro-ecological and economic points of view. The nursery established on December 5, 2025, is an important platform for scientifically based intensive gardening and the production of healthy planting material in the region.

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BIOLOGICAL SCIENCES

COMPOSITION AND ECOLO-TROPHIC RELATIONS OF THE MYCOBIOTA OF CULTIVATED PLANTS IN THE KUR-ARAZ REGION

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Abstract

As it is known, any ecosystem, including the territory of natural coenoses, agrophytocoenoses, is a dynamic and constantly developing natural system, as the totality of populations of all types of fungi that inhabit it. For this reason, clarifying the nature of the processes occurring in any ecosystem, determining the role of its individual components, begins with the determination of the taxonomic affiliation of the organisms living in that ecosystem, and more specifically, the species composition, and this approach is the only approach accepted by everyone and considered universal today in mycological research.

Keywords: ecosystem, natural system, parasitism, fungi

Introduction: Therefore, in the research conducted, we first studied the area, that is, the Kura-Araz plain, which is the main geomorphological units of the Republic of Azerbaijan, located between the Greater Caucasus, the Lesser Caucasus (together with the Karabakh plateau) and the Talysh mountains, and which forms the basis of the flat part of the country's territory (more precisely, in the Aran economic region) the species composition of the fungi associated with cultivated plants was determined. From the obtained results, it became clear that 112 species of fungi and mushroom-like organisms are distributed in the vegetative and generative organs of cultivated plants in Kura-Araz plain.

Material and method: As it was mentioned in the previous parts of the work, since the systematics of fungi is the object of discussion even today, there is no unified system accepted by everyone. For this reason, mainly in research,

It was considered appropriate to give preference to the system used on the official website of the International Mycological Association (IMA).Most of the recorded fungi belong to the anamorphic forms of sac fungi (76 species), that is, the undefined (Deuteromucota) fungi that are still widely used in the literature. The next places are occupied by fungi belonging to the department Basidiomycota (13 species), Zygomycota (6 species) and Ascomycota (telemorphs) (7 species). Fungi-like organisms, that is, belonging to the order Chromista, are represented by 10 species, which makes up 8.9% of recorded fungi.Anamorphic fungi have a relative superiority in terms of the number of species in the mycobiota of any area[1,7,11,14,27]. For example, research conducted in Russia found that the vast majority of fungi observed on ornamental plants belong to anamorphic fungi, and it was shown that 126 of the 154 species related to parasitism among the recorded fungi belong to anamorphic fungi. 91 (52.9%) of the 172 mushroom species recorded in the Mugan plain, 72 (82.8%) of the 87 species recorded in essential oil plants, and 69 of the 86 species recorded in the plants cultivated on the Absheron Peninsula. u(80.2%) was determined to belong to anamorphic fungi.

When the recorded mycobiota is characterized by its genus composition, it becomes clear that fungi belonging to the genera Penicillium and Fusarium are represented by more species (8 species) in the formation of the mycobiota of cultivated plants in the Kura-Araz plain. Ascochyta and Septoria fungi are represented by 7 species in this process. 6 species of Aspergillus genus, 5 species of genera such as Alternaria, Colletotrichum and Phoma participate in the formation of the mycobiota of the studied plants. The remaining genera are represented by 1-4 species in the formation of this or that plant, as well as the general mycobiota of the area [23,27,30].

Although the representation of one or another genus in the mycobiota of any area or plant opens up certain perspectives for the possibility of using fungi as indicators, it is not always appropriate to take this as an indicator of their dominance. For example, the genera Botrytis and Rhizopus are represented by only one species in the formation of the mycobiota of cultivated plants in the Kura-Araz plain, but they can almost use the majority of the cultivated plants as food.

Comparing the obtained results with the results of the mycological studies conducted in Azerbaijan until now, it is clear that the distribution of some fungi in the nature of Azerbaijan is unknown, and the number of such fungi is equal to 11, which consist of the following species:Mucor corticola Hagem Penicillium stolon-iferum Thorn.?P.puberulum Bainier,Verticellium pul-verulentum Couwenteg ,Phoma roumii Fron.,Ph. minulella Sacc et. Penz.,Dicoccum asperum(Corda) Saccardo

Ascochyta anethicola Sacc.,Asc. pinodes (Berk.et. Blox) Jones.,Sclerotinia borealis Bubak et Vleugel., Septoria sojina Thuern

According to the system given on the official website of BMA, 1 of the fungi recorded in the nature of Azerbaijan for the first time belongs to zygomycetes (Mucor corticola), 1 - to telemorphs of sac fungi

(Sclerotinia borealis), and the rest to anomorphs of sac fungi.

It should be noted that currently most researchers believe that the number of mushroom species known to science today is 5-10% of the actual number in nature. In research conducted in a small area of the world such as Kura-Araz, the discovery of many species that are new to that area, as well as in other researches conducted in Azerbaijan, both for the mycobiota of Azerbaijan and new species for science the discovery of its spread also proves the correctness of the mentioned idea once again[1-4,8,11,18,24].

As for the distribution of fungi recorded in the study area on individual plants, it became clear that the distribution of fungi on plants is uneven, and among the studied cultivated plants, tomato and wheat are characterized by a relatively rich mycobiota, while garlic is characterized by a low mycobiota.

Distribution of fungi on individual plants

Plants	Taxonomic relationship of mushroom species					Total
	Oomycota	Zygomycota	Ascomycota		Bazidio-mycota	
			Telemorf	Anamorf		
Wheat	2	1	3	22	4	32
Barley	0	1	2	22	4	29
Corn	0	1	1	18	3	23
Watermelon	1	1	0	21	0	23
Tomato	2	1	1	29	1	34
Eaten	1	2	0	28	0	31
Cabbage	1	0	1	6	0	8
Potato	1	0	0	11	2	14
It's a beet	2	2	3	18	2	27
Peas	1	1	1	16	2	21
Beans	1	1	2	16	3	23
Soya	1	1	1	8	1	12
Eggplant	2	2	1	18	1	24
Pumpkin	1	2	2	10	1	16
Cotton	0	0	2	16	0	18
Millet	0	1	1	6	1	9
Onion	1	0	0	6	3	10
Garlic	1	0	0	2	1	4

Thus, 32-34 species are involved in the formation of the mycobiota of tomatoes and wheat, and only 4 species are involved in the formation of the mycobiota of garlic. 10-29 species are involved in the formation of mycobiota of the rest. This is confirmed by the data in table 3.1. As can be seen from the table, the host plants of fungi can be conditionally divided into 3 groups, the first group includes those with more than 20 species of mycobiota, the second group includes 10-20 species involved in the formation of the mycobiota, and the third group includes those with less than 10 species of fungi. . According to the mentioned division, the vast majority of plants (tomato, wheat, barley, corn, watermelon, walnut, eggplant, beans, sugar beet, etc.) should be included in the first group. The second group includes soybeans, potatoes, pumpkins and cotton, and the third group includes vegetables such as cabbage, millet, onions and garlic.In our opinion, the uneven distribution of fungi according to the number of species on plants is due to several reasons[28].

The first one is related to the fact that plants characterized by a rich mycobiota and conventionally included in the first group are more massively cultivated in the studied areas[5,11,18-24]. In this case, it is considered favorable conditions for the species specific for the mycobiota of this or that plant to repopulate that plant in the next vegetation year.Secondly, the biochemical nature of the composition of the plants itself also plays a certain role in this matter, as in the case of garlic, that is, the fact that the plant itself has antibiotic activity is considered to be one of the factors that cause the deterioration of its mycobiota.

Finally, the last in this matter is the degree of mycological purity of the seeds themselves used for planting. So, it is one of the confirmed facts that seeds also play a certain role in the spread and transmission of this or that fungal disease . This is due to the fact that the organization of the mycological examination of the seeds used for planting is not at the desired level today, sometimes the mycological purity of the seeds for planting is used by visual assessment of the ones obtained in an artisanal way, etc. also confirms[1-4,8,12,17].

There is another point of interest from the results obtained regarding the distribution of fungi on individual host plants. This is due to the fact that not all taxonomic groups of fungi are involved in the formation of the mycobiota of some plants. For example, representatives of 3 departments are not involved in the formation of the mycobiota of cotton, 2 in the formation of the mycobiota of watermelon, cabbage, garlic and onion, and 1 in the formation of the mycobiota of barley and corn. In our opinion, it would be correct to look for the reason for this both in the biochemical composition of plants and in the mutual relations between fungi belonging to separate taxonomic groups.

Conclusion: During the characterization of the fungi recorded in mycological studies conducted in the world, as well as in Azerbaijan, the geographical elements of their distribution are also touched upon,

and based on this, the model of areal classification proposed by botanists, more specifically, A.A. Grosgame for the Caucasian flora, refined by a number of authors . It should be noted that a number of fungi distributed in Azerbaijan were characterized based on this model and the results of all of them were somewhat similar. The essence of this similarity lies in the high influence of the northern factor in the formation of the mycobiota characteristic of the nature of Azerbaijan, and as a result of this, most of the mushrooms recorded in Azerbaijan belong to the boreal type. For example, 69.8% of the fungi recorded in the studies conducted in the Mughan Plain, 52.3% of the species participating in the formation of the mycobiota of agricultural plants cultivated in Absheron have the characteristics specific to the boreal type. The characteristic feature of this type is that it covers Europe, Asia and North America, the northern temperate climate zone of Europe and Asia, Northern Europe, as well as some southern regions of Europe, the steppe zone from Hungary to Northern Kazakhstan, and species located in the steppes of the North Caucasus.

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MULBERRY TREE: A VALUABLE GIFT OF NATURE

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Abstract
The mulberry tree (*Morus* spp.) is a widely distributed and economically significant plant with substantial ecological and nutritional value. This study highlights the biological characteristics, diversity, and practical importance of mulberry species, particularly in Azerbaijan. Special attention is given to its role in agriculture, sericulture, environmental protection, and human health.

Keywords: mulberry tree, fruit, leaf, medicine, vitamin, silk

The mulberry tree is one of the widely distributed plants in nature and has great importance in human life. Belonging to the Moraceae family, this tree mainly grows in temperate and subtropical climate zones and is also широко распространен in Azerbaijan. The mulberry tree plays an important role both in natural ecosystems and in agriculture.

There are 17 species of mulberry in the world, and 3 in Azerbaijan: *Morus alba L.* (white mulberry), *Morus nigra L.* (black mulberry), and *Morus rubra L.* (red mulberry). These species differ from each other in the color, taste, and ripening time of their fruits. Through folk selection, a number of high-quality new mulberry varieties have been developed in Azerbaijan, such as Shahtut, Bedana mulberry, Khar mulberry, Ganja mulberry, Shirvan mulberry, etc.

Researchers at the Institute of Genetics and Selection of ANAS have created new mulberry varieties such as Zarif mulberry, Azeri mulberry, Khanlar mulberry, Firudin mulberry, Yagub mulberry, Emin mulberry, Zakir mulberry, and Gozel mulberry, which produce 2–3 times more leaf yield than local wild varieties using various breeding methods.

The most valuable part of the mulberry tree is its fruit. Mulberry fruits can be white, black, or red. These fruits are rich in vitamins, especially vitamin C, B-group vitamins, and various minerals. In addition, they contain different antioxidants that are important for the human body. Regular consumption of mulberry fruits strengthens the immune system and improves overall health.

The leaves of the mulberry tree are also very important. As is known, the silkworm feeds only on mulberry leaves. Therefore, the mulberry tree forms the basis of the silk industry. Without mulberry leaves, silk production would not be possible. Sericulture has developed throughout history in many countries, including Azerbaijan, and has played an important economic role. The cultivation of mulberry trees is essential for the sustainable development of this field.

The mulberry tree is a long-lived and resilient plant. Its root system is well developed, penetrating deep into the soil, preventing erosion, and contributing to environmental improvement. Its trunk is thick and strong. Mulberry wood is used in some household and craft applications.

Various food products are made from mulberry fruits. They are used to prepare jam, syrup, dried fruits, and other delicious products. In folk medicine, both the fruits and leaves of the mulberry tree are used to treat various diseases.

Planting mulberry orchards along roads in Azerbaijan is a commendable practice. Establishing mulberry plantations along field borders and in unused riverbed areas is important for the future. The role of mulberry in solving food problems, its use as a medicinal resource, and its contribution to air purification should be highly appreciated.

Currently, meliorative greening works are being carried out around main canals and collectors in our republic. For this purpose, mulberry planting is widely used.

Creating forest belts, establishing forest massifs, expanding its use as an ornamental plant in residential areas, and developing productive modern varieties of this beneficial plant are among the important tasks.

Conclusion: The mulberry tree is a highly beneficial plant both economically and ecologically. Its protection and widespread cultivation are of great importance for the well-being of society.

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FLORISTIC COMPOSITION AND PHYTOCENOLOGICAL CHARACTERISTICS OF THE *POETA PRATENSIS–THYMETUM COLLINUS–ALCHEMILLOSUM ERYTHROPODA* ASSOCIATION (GADABAY REGION, AZERBAIJAN)

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Abstract

The study aimed to investigate the phytocenological characteristics of alpine meadows in the Lesser Caucasus of Azerbaijan. The association *Poeta pratensis–Thymetum collinus–Alchemillosum erythropoda* was identified in the alpine meadow zone of Mount Kechal (Gadabay District) at an altitude of 2967 m on mountain meadow soils. The phytocenosis comprised 26 vascular plant species, including 7.7% shrubs, 3.8% semi-shrubs, 73.1% perennial herbs, and 15.4% biennial herbs. Ecological analysis revealed the predominance of xerophytes (46.2%), followed by mesophytes (42.3%) and mesoxerophytes (11.5%).

Alchemilla erythropoda was the dominant species, while *Thymus collinus* and *Poa pratensis* were subdominants. The vegetation exhibited a three-layered structure with an average height of 10–35 cm and a total cover of 70–90%. Several poisonous and unpalatable species reducing pasture quality were also recorded. The results contribute to the assessment of biodiversity, ecological structure, and pasture value of alpine meadow ecosystems in Azerbaijan.

Keywords: alpine meadows, phytocenosis, biodiversity, *Poa pratensis, Thymus collinus, Alchemilla erythropoda*, Azerbaijan.

Alpine meadows are one of the main vegetation types of high mountain areas, distinguished by their rich floristic composition, high fodder value and ecological functions. These ecosystems play an important role in regulating soil formation processes in mountain landscapes, protecting the water regime and maintaining biodiversity. The formation of alpine meadows occurs as a result of the interaction of climate, relief, soil and anthropogenic factors, and their species composition varies depending on the ecological conditions of the area.

The Lesser Caucasus mountain system of Azerbaijan is one of the important botanical-geographic regions where alpine and subalpine meadows are widely distributed. These areas are characterized by rich plant diversity and constitute the distribution area of many endemic, relict and economically valuable species. In recent years, as a result of intensive grazing, climate change and other anthropogenic impacts, certain changes have been observed in the structure and floristic composition of high mountain meadows [24,25]. Therefore, studying the current state of these phytocenoses and assessing their ecological and phytocenological characteristics is one of the urgent scientific problems.

Kechal Dag, located in the Gadabay region, is considered one of the important natural areas distinguished by its rich floristic diversity of alpine meadows. Plant groups adapted to various ecological conditions have formed here and have created a complex phytocenological structure. In addition to species of fodder, medicinal and decorative importance, these groups also contain harmful and poisonous plants that reduce the quality of pastures [1-4, 7,14-16].

The aim of the study is to study the floristic composition, biomorphological and ecological structure, dominant-subdominant species, layering and pasture importance of the *Poeta pratensis–Thymetum collinus–Alchemillosum erythropoda* association spread on Kechal Dag, Gadabay region. The results obtained are of great importance for the scientific classification of high mountain meadows, protection of biodiversity and efficient use of pastures [26,28].

The studies were conducted in the alpine meadow belt of Kechal Dag in the Gadabay district, which is part of the Lesser Caucasus botanical-geographical region of Azerbaijan. The study area is located at an altitude of 2967 m above sea level and is characterized mainly by grassy mountain-meadow soils. The climate of the area is characterized by cool summers and cold and snowy winters, which creates favorable conditions for the formation of alpine meadow vegetation.

Field studies were carried out using route and stationary observation methods. During the study of plant groups, geobotanical descriptions were made, the floristic composition of species, the degree of abundance, the project cover and the storey of the phytocenosis were determined. The abundance of species was assessed based on the Drude scale, and the total project cover was expressed in percent.

When determining plant species, fundamental publications on the flora and vegetation of Azerbaijan were used, including “Flora of Azerbaijan”, “Vegetation of Azerbaijan” and other taxonomic sources. The nomenclature of species has been adapted to modern systematic principles [11,14,17,21,23].

During the biomorphological analysis of the phytocenosis, the species were divided into groups of shrubs, subshrubs, perennial and biennial herbs according to their life forms. In the ecological analysis, the xerophyte, mesoxerophyte and mesophyte ecological groups were determined, taking into account the relationship of plants to humidity.

As a result of the processing of geobotanical materials, the floristic composition, dominant and subdominant species, layer structure, ecological spectrum and pasture importance of the *Poeta pratensis–Thymetum collinus–Alchemillosum erythropoda* association, which is widespread in the alpine meadow vegetation, were analyzed [2,5,8,12].

As a result of the conducted geobotanical studies, the association *Poeta pratensis–Thymetum collinus–Alchemillosum erythropoda* was identified in the alpine meadows located on Kechal Mountain in the Gadabay region, at an altitude of 2967 m above sea level. The association was formed on grassy mountain-meadow soils and is characterized by a rich floristic composition.

26 species of higher plants were recorded in the floristic composition of the association. Analysis of life forms showed that the main part of the species is perennial herbs (73.1%). This indicator confirms that alpine meadows are stable and long-term formed phytocenoses. The minority of shrubs (7.7%) and semi-shrubs (3.8%) is due to the influence of harsh climatic factors in high mountain conditions. The share of dioecious herbs was 15.4%.

As a result of the analysis of ecological groups, it was determined that xerophytic species predominate (46.2%). The specific weight of mesophyte species was 42.3%, and mesoxerophytes - 11.5%. The close ratio of xerophyte and mesophyte elements reflects the seasonal variability of humidity and temperature conditions of alpine meadows [12,24,25,27]. This feature indicates the ecological diversity and adaptation capabilities of high mountain ecosystems.

The dominant species of the association was *Alchemilla erythropoda* Juz. The abundance of the species determines the general appearance and structure of the phytocenosis, with a score of 3–4. *Thymus collinus* Bieb. and *Poa pratensis* L. act as subdominant species. The high abundance of all three species was taken as the basis for naming the association. The ecological characteristics of the dominant and subdominant species indicate that they are well adapted to the harsh conditions of the alpine zone.

The phytocenosis has a three-story structure. The first floor is occupied by shrub species such as *Daphne mezereum* L. and *Rosa canina* L. The second floor is dominated by *Poa pratensis, Festuca versicolor, Salvia glutinosa* and other tall herbaceous plants. The third layer is mainly represented by low-growing species such as *Alchemilla erythropoda, Thymus collinus, Cirsium tomentosum* and *Euphorbia macroceras*. Such a layering not only increases the ecological stability of the phytocenosis, but also ensures the distribution of space and resources between species [1-4,9,11].

The average height of the vegetation cover varied between 10–35 cm, and the total project cover was 70–90%. The high project cover indicates that the phytocenosis is well developed and most of the soil surface is covered with plants. This has a positive effect on protecting the soil from erosion and maintaining the stability of the ecosystem.

Some harmful and poisonous species that are not eaten by livestock and reduce the quality of pastures have also been identified in the association. The widespread distribution of these species can limit the development of productive forage plants and reduce the economic importance of pastures. Therefore, it is considered appropriate to implement phyto-ameliorative measures, regulate grazing load and control the spread of harmful species in order to protect and efficiently use pasture ecosystems.

Thus, the *Poeta pratensis–Thymetum collinus–Alchemillosum erythropoda* association is a plant grouping with high biodiversity and complex phytocenological structure, typical for the alpine meadows of the Gadabay region. The floristic and ecological characteristics of the association indicate that it has significant scientific and practical importance in terms of the protection and sustainable management of high mountain ecosystems.

The ***Poeta pratensis–Thymetum collinus–Alchemillosum erythropoda*** association was identified in the alpine meadows of Mount Kechal (Gadabay District, Azerbaijan) at an altitude of 2967 m. The association comprised 26 vascular plant species, with perennial herbs dominating the floristic composition. Ecological analysis revealed the predominance of xerophytic and mesophytic elements, while ***Alchemilla erythropoda*** was the dominant species and ***Thymus collinus*** and ***Poa pratensis*** were subdominants.

The phytocenosis is characterized by high biodiversity, a three-layered structure, and a vegetation cover of 70–90%. The presence of poisonous and unpalatable species indicates the need for appropriate pasture management and phyto-ameliorative measures. The obtained results contribute to the phytocenological classification, biodiversity assessment, and sustainable management of alpine meadow ecosystems in Azerbaijan.

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EXPERIMENTAL MODELING OF MASS CONCENTRATION OF DUST STORM PRODUCTS IN THE ARALKUM DESERT

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ЭКСПЕРИМЕНТАЛЬНОЕ МОДЕЛИРОВАНИЕ МАССОВОЙ КОНЦЕНТРАЦИИ ПРОДУКТА ПЫЛЬНЫХ БУРЬ НА ТЕРРИТОРИИ ПУСТЫНИ АРАЛКУМ

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Abstract

The paper presents the calculation results of the mass concentration of salt-and-sand particles based on field measurements of their number concentration in an artificially generated dust cloud within the Aralkum Desert. Particle fractions with diameters ranging from 0.3 to 10 μm were investigated. The particulate matter parameters were measured using an optical aerosol counter under varying airflow velocities (generated by a blower unit) and underlying surface types, with air temperature, air humidity, and soil moisture kept constant. The authors performed a detailed analysis of the distribution patterns of salt-and-sand particle mass concentration as a function of their size, airflow dynamic characteristics, and the lithological soil type of the dried Aral Sea bed. Based on the empirical data obtained, a quantitative assessment of the potential emission capacity of dust sources was carried out for various landscape types.

Аннотация

В статье представлены результаты расчета массовой концентрации соле-песчаных частиц на основе данных экспедиционных измерений их счетной концентрации в искусственно сформированном пылевом облаке на территории пустыни Аралкум. Исследованы фракции частиц диаметром от 0,3 до 10 мкм. Измерения параметров дисперсных систем проводились с использованием оптического счетчика аэрозолей при варьировании скорости воздушного потока (генерируемого воздуходувной установкой) и типа подстилающей поверхности в условиях фиксированной температуры, а также влажности воздуха и почвы. Авторами проведен детальный анализ закономерностей распределения массовой концентрации соле-песчаных частиц в зависимости от их дисперсности, динамических характеристик воздушного потока и литологического типа почвы высохшего дна Аральского моря. На основе полученных эмпирических данных выполнена количественная оценка потенциальной мощности эмиссии очагов пылевыноса для различных типов ландшафта.

Keywords: salt-sand storm, particle number, mass concentration, wind speed, soil type, soil moisture, emission coefficient, potential source power.

Ключевые слова: соле-песчаная буря, число частиц, массовая концентрация, скорость ветра, тип почвы, влажность почвы, коэффициент эмиссии, потенциальная мощность источника.

Введение

Осушенное дно Аральского моря характеризуется выраженной геоморфологической неоднородностью подстилающей поверхности, представленной самосадочными солончаками (пухляками), песчаными барханами и зонами с развитыми солевыми корками. Пятнистый характер распределения элементов рельефа, чередование солончаковых и песчаных массивов, различная степень их закрепленности псаммофильной растительностью, а также наличие защитного песчано-солевого панциря обусловливают высокую пространственно-временную изменчивость коэффициента эмиссии аэрозоля. Песчаная корка, сдерживающая дефляцию при слабых ветрах, подвергается лавинному разрушению при достижении критических пороговых скоростей воздушного потока, что приводит к залповому выбросу мелкодисперсных фракций в атмосферу. Указанные факторы существенно усложняют параметризацию граничных условий и верификацию корректных математических моделей динамики пылепереноса с очагов дефляции Аралкума.

В отличие от классических аридных регионов, твердофазный аэрозоль осушенного дна Аральского моря характеризуется высоким содержанием остаточных количеств пестицидов, гербицидов и токсичных солей (преимущественно сульфатов и хлорида натрия). Данные дисперсные системы, имеющие преимущественно галогенно-сульфатный состав, обладают выраженной гигроскопичностью [10]. Интенсивное поглощение атмосфер-ной влаги приводит к фазовым переходам, изменению эффективной массы, плотности и, что критически важно, сечения оптического ослабления частиц [12,15].

Вследствие высокой гигроскопичности солевые аэрозоли выступают в роли эффективных ядер конденсации. Данный фактор трансформирует микрофизические параметры облачного покрова, его альбедо и, как следствие, режим формирования и распределения осадков в Центральноазиатском регионе [4]. Более того, физико-химические свойства упомянутых гидрофильных частиц обусловливают их высокую ингаляционную опасность: при попадании в респираторный тракт происходит их быстрая гидратация («разбухание»), что потенцирует местное и системное токсическое воздействие на организм человека [3, 11].

Экспериментальное моделирование динамики массовой концентрации и трансграничного переноса пылевого аэрозоля с осушенного дна Аральского моря представляет собой ресурсоемкую и комплексную задачу аэрозольной физики, что обусловлено специфическим физико-химическим составом дефляционного материала и высокой нестабильностью ландшафтных структур. Для верификации прогностических моделей и выполнения прецизионных расчетов необходимы непрерывные данные лидарного зондирования и наземных станций экологического мониторинга, расположенных непосредственно в очагах пылевыноса. Ввиду отсутствия развернутой сети подобных инструментальных комплексов на исследуемой территории Республики Узбекистан, проведение натурных экспедиционных измерений на современном этапе является единственным репрезентативным методом восполнения дефицита эмпирических данных.

В настоящей работе представлены результаты численной оценки массовой концентрации солепесчаных частиц C [мг/м³] в диапазоне диаметров от 0,3 до 10 мкм, а также пространственно-временной анализ их распределения в пределах пустыни Аралкум. Расчеты базируются на массивах экспедиционных данных счетной концентрации аэрозоля, полученных для различных литологических типов почв и гидродинамических режимов воздушного потока при фиксированных значениях температуры, относительной влажности воздуха и термодинамической влажности почвенного покрова.

Целью настоящего исследования является расчёт и пространственно-динамический анализ распределения массовой концентрации соле-песчаных аэрозолей на основе натурных экспедиционных данных о счетной концентрации мелкодисперсных фракций в пустыне Аралкум. Исследование выполнялось при дискретных значениях скорости воздушного потока и фиксированных параметрах окружающей среды: температуре воздуха, относительной влажности атмосферы и влажности почвы на глубине 10 см. В качестве сопутствующей задачи авторами проведена количественная оценка потенциальной мощности эмиссии очагов дефляции для различных типов ландшафта.

Объектом исследования высту-пает искусственно генерируемая дисперсная система (аэродисперсное облако) на территории пустыни Аралкум, предназначенная для прецизионной фиксации количественных и параметрических характеристик аэрозольных частиц в единице объема воздушной среды.

Материалы и методы исследования. Эмпирическую основу исследования составили массивы данных, полученные в ходе натурных экспедиционных измерений в рамках научноисследова-тельского проекта AL-9424114994. В ходе полевых работ регистрировались физические параметры солепесчаных частиц, температура и относительная влажность воздуха на высоте 1 м над поверхностью субстрата, температура поверхности почвы и на глубине 10 см, термодинамическая влажность почвы, а также фоновая скорость естественного ветра.

Дисперсный состав и счетная концентрация мелкодисперсных аэрозольных фракций в диапазоне диаметров от 0,3 до 10 мкм определялись с помощью портативного оптического анализатора

счетной концентрации частиц. Измерения выполнялись как при фоновой скорости ветра, так и в условиях искусственно генерируемых воздушных потоков со скоростями 5, 10, 15 и 20 м/с. Заданная ступенчатая градация скоростей обеспечивалась применением калиброванной воздуходувной установки. Исследования проводились вдоль экспедиционного маршрута (рис. 1), характеризующегося вариативностью плотности растительного покрова и литологической структуры почв. Общая площадь полигона экспедиционных исследований составила 112 км² (рис. 1).

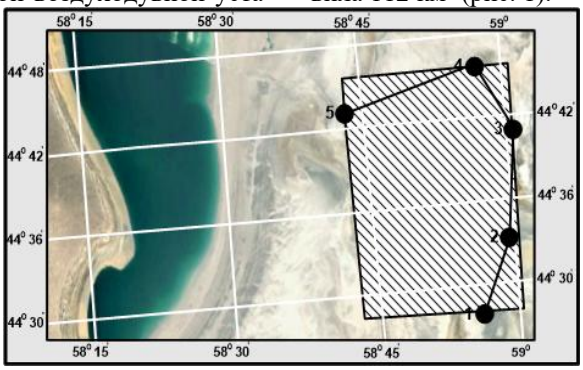


Рис. 1.

Схема экспедиционного маршрута и пространственное расположение полигонов натурных измерений.

Для перехода от счетной концентрации аэрозоля к массовой принято допущение о сферической форме мелкодисперсных частиц. Предполагается, что твердофазный субстрат преимущественно состоит из диоксида кремния (SiO_2) с константным значением плотности ρ□□□2650 кг/м³. Массовая концентрация

M [мг/м³] для ансамбля из частиц определяется из следующего аналитического выражения:

$$M=m_p \cdot N, \quad (1)$$

где $m_p = \rho \square \cdot V_p$ – масса одной частицы, а $V_p = \pi \cdot d^3 / 6$ – объём, занимаемый N частицами.

Параметризация процессов турбулентного обмена включает определение вертикального потока массы аэрозоля [мг/(м²·с)] в соответствии с диффузионным законом Фика [6]:

$$F = -K_z \frac{dM_\Sigma}{dz}, \quad (2)$$

где $M_\Sigma = \sum_{i=1}^{n} M_i$ – суммарная концентрация частиц i-ых фракций, z – высота, $K_z = = u^* z$ – коэффициент турбулентной диффузии, оценка которого выполняется через динамическую скорость u^*, определяемую из соотношения

$$u^* = 0{,}4 \frac{v}{ln(z/z_o)}, \; v - \text{скорость ветра}. \quad (3)$$

В (3) z_o = 0,001м – коэффициент шероховатости принят для солончаков.

Высота слоя перемешивания h [м] определяет вертикальные границы воздушного бассейна, в котором локализованы пылевые частицы. Для синоптических и ландшафтно-климатических условий пустыни Аралкум данная величина варьирует в диапазоне от 500 до 1500 м [8; 15]. В рамках настоящей работы принято константное значение h = 1000 м.

При скоростях приземного ветра, превышающих пороговое значение 5 м/с, в условиях стационарного источника пылевыноса вертикальный поток трансформируется в интенсивный турбулентный режим.

Для практического расчёта потока на основе измерений на фиксированной высоте z дифференциальный градиент $dM_\Sigma / \mathrm{d}z$ аппроксимируется методом конечных разностей в пределах приземного слоя (от поверхности земли до высоты датчика):

$$\frac{dM_\Sigma}{dz} \approx \frac{M_\Sigma(z) - M_\Sigma(0)}{z}.$$

Согласно концепции *«clean» sur-face emission method* [13], рассматривается изолированный процесс вертикального выноса («чистой» генерации) аэрозоля воздушным потоком. При этом принимаются следующие граничные условия: на внешней (верхней) границе исследуемого микрослоя концентрация пыли стремится к фоновому (нулевому) значению по сравнению с мощным искусственным выбросом у земли $M_\Sigma(0) \to 0$; у самой поверхности ($z \to 0$) концентрация аэрозоля в облаке максимальна и равна измеряемой величине M_Σ. Подстановка этих условий в разностную схему меняет знак градиента, так как концентрация убывает с высотой:

$$\frac{dM_\Sigma}{dz} \approx \frac{0 - M_\Sigma}{z} = -\frac{M_\Sigma}{dz}.$$

При подстановке полученного отрицательного градиента в исходное уравнение (2) знак «–» меняется на «+», что отражает сонаправленность вектора потока F массы с осью z (направление снизу вверх). В результате уравнение (2) преобразуется в уравнение (4):

$$F = K_z \frac{M_\Sigma}{z}. \quad (4)$$

Для количественной оценки интегральной мощности эмиссии очага пылевыноса W [мг/с] с площади исследуемо-го полигона применяется полуэмпирическое соотношение вида (5) [1]:

$$W = F \cdot S \cdot ln\frac{h}{z_o}. \quad (5)$$

Множитель логарифмическо про-филя в уравнении (5) аппроксимирует вертикальное распределение дисперсных фракций по всей высоте слоя перемешивания. Однако, учитывая описанную выше специфику и высокую пространственную неоднородность осушенного дна Аральского моря, интегральная мощность эмиссии очагов дефляции W в настоящей работе рассчитывалась по специализированной методике Главной геофизической обсерватории (ГГО) для активных солончаковых ландшафтов Аралкума [2]. Расчетное выражение имеет следующий вид:

$$W = M_\Sigma \cdot S \cdot \frac{K_z}{z} \Phi, \quad (6)$$

где Φ – безразмерная функция интенсивности дефляционного выноса, характеризующая степень превышения динамической скорости трения воздушного потока над её пороговым значением. Для рассматриваемых физико – географических условий при пересчете на объемную эмиссию значение данной функции принято константным и равным Φ=100 единиц.

Результаты и их обсуждение

На рис. 2 представлены результаты расчета массовой концентрации мелкодисперсных частиц в зависимости от их дисперсности (диаметра) при дискретных значениях скоростей воздушного потока на полигонах с различной литологической структурой почвенного покрова.

На первый взгляд, топология полученных кривых распределения обнаруживает кажущийся парадокс: при экстраполяции в область более высоких скоростей ветра абсолютные значения массовой концентрации соле-песчаных частиц оказываются ниже, чем при умеренных воздушных потоках.

Физическое обоснование зарегистрированного снижения массовой концентрации аэрозоля при возрастании динамического воздействия воздушного потока базируется на действии пяти синергетических аэродинамических и литологических механизмов.

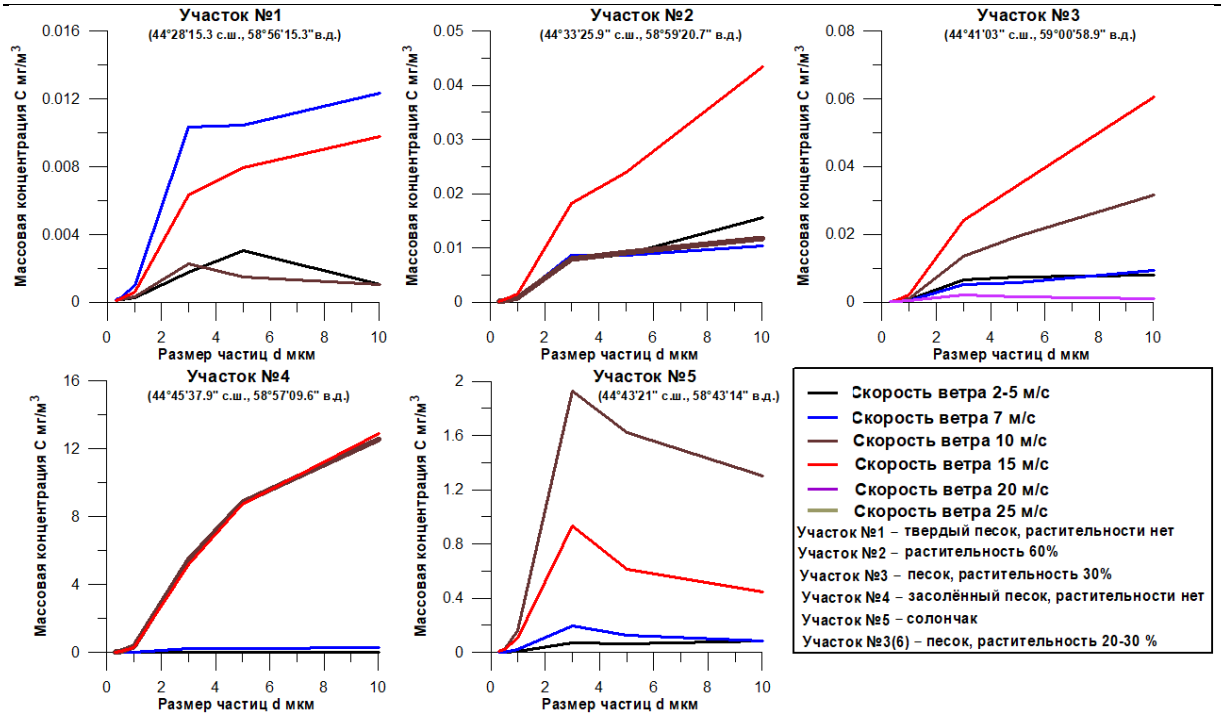
Во-первых, проявляется эффект интенсивной адвекции и турбулентного разбавления (дилюции). Иначе говоря, при слабых ветрах генерируемый дефляционный материал аккумулируется непосредственно над очагом эмиссии, формируя устойчивое аэродисперсное облако, однако при усилении ветрового режима скорость горизонтального переноса мелкодисперсных фракций начинает кратно превышать скорость их вертикальной генерации, распределяя ту же массу частиц в существенно большем объеме воздушной среды.

Во-вторых, происходит истощение дефляционного потенциала подстилающей поверхности, поскольку продолжительное воздействие высокоскоростного потока приводит к быстрой эвакуации мобильного резерва сухого мелкодисперсного материала, оставляя на субстрате лишь крупные, гидравлически стабильные фракции диаметром, значительно превышающим 10 мкм, чья скорость страгивания превышает текущую силу ветра.

В-третьих, трансформируется вертикальный профиль турбулентной диффузии: если при умеренных режимах основная масса пыли локализована в приземном микрослое на высоте пробоотбора (z=1 м), то сильный ветер резко увеличивает вертикальный коэффициент диффузии K_z, эффективно транспортируя частицы восходящими вихрями на высоты до сотен метров.

В-четвертых, активизируются про-цессы турбулентной коагуляции и гравитационного осаждения, когда из-за высокой интенсивности вихрей возрастает частота межчастичных столкновений, приводящая к укрупнению фракций, а мощные нисходящие компоненты флуктуационной скорости принудительно возвращают частицы к земле в зонах динамического сопряжения.

В-пятых, ключевую роль играют динамика страгивания и кинематика транзитной салтации [9]; при достижении критической скорости $v \geq v_{кр}$ наблюдается экспоненциальный рост эмиссии, однако при переходе к экстремальным значениям темп прироста концентрации лимитируется изменением моды транспортировки – частицы переходят в режим высокоскоростного скачкообразного движения по пологим баллистическим траекториям [14], из-за чего проводят меньше времени в фиксированной точке сканирования оптического датчика и пролетают зону пробоотбора транзитом.


Участок №1
(44°28'15.3 с.ш., 58°56'15.3"в.д.)
Участок №2
(44°33'25.9" с.ш., 58°59'20.7" в.д.)
Участок №3
(44°41'03" с.ш., 59°00'58.9" в.д.)
Участок №4
(44°45'37.9" с.ш., 58°57'09.6" в.д.)
Участок №5
(44°43'21" с.ш., 58°43'14" в.д.)
Массовая концентрация С мг/м3
Размер частиц d мкм
Скорость ветра 2-5 м/с
Скорость ветра 7 м/с
Скорость ветра 10 м/с
Скорость ветра 15 м/с
Скорость ветра 20 м/с
Скорость ветра 25 м/с
Участок №1 – твердый песок, растительности нет
Участок №2 – растительность 60%
Участок №3 – песок, растительность 30%
Участок №4 – засолённый песок, растительности нет
Участок №5 – солончак
Участок №3(6) – песок, растительность 20-30 %

Примечание: кординаты относятся к центру участков, показанных на рис. 1.

Рис. 2. *Дифференциальное распределение расчетной массовой концентрации мелкодисперсных аэрозолей различных фракций в зависимости от их диаметра при дискретных скоростях воздушного потока на полигонах с различной литологической структурой почв.*

Таким образом, снижение массовой концентрации аэрозольных частиц при достижении критических скоростей воздушного потока представляет собой закономерный физический процесс, обусловленный преобладанием темпов турбулентной диссипации и горизонтальной адвекции над интенсивностью вертикальной эмиссии новых дисперсных фракций. Тем не менее, необходимо учитывать, что в условиях ураганного ветра (v>30 м/с) механизмы локального истощения и рассеяния перестают быть доминирующими: в эоловый транспорт вовлекаются практически все фракции твердофазного субстрата, формируя протяжённый и плотный аэрозольный шлейф. В данном динамическом режиме генерируемый ансамбль частиц приобретает избыточную кинетическую энергию турбулентных вихрей и переходит в состояние устойчивой высокодисперсной суспензии (аэровзвеси) в атмосферном столбе.

На рис. 3 представлены зависимости потенциальной мощности эмиссии очагов дефляции в пустыне Аралкум от скорости ветра для различных типов ландшафта, аппроксимированные полиномиальными уравнениями.

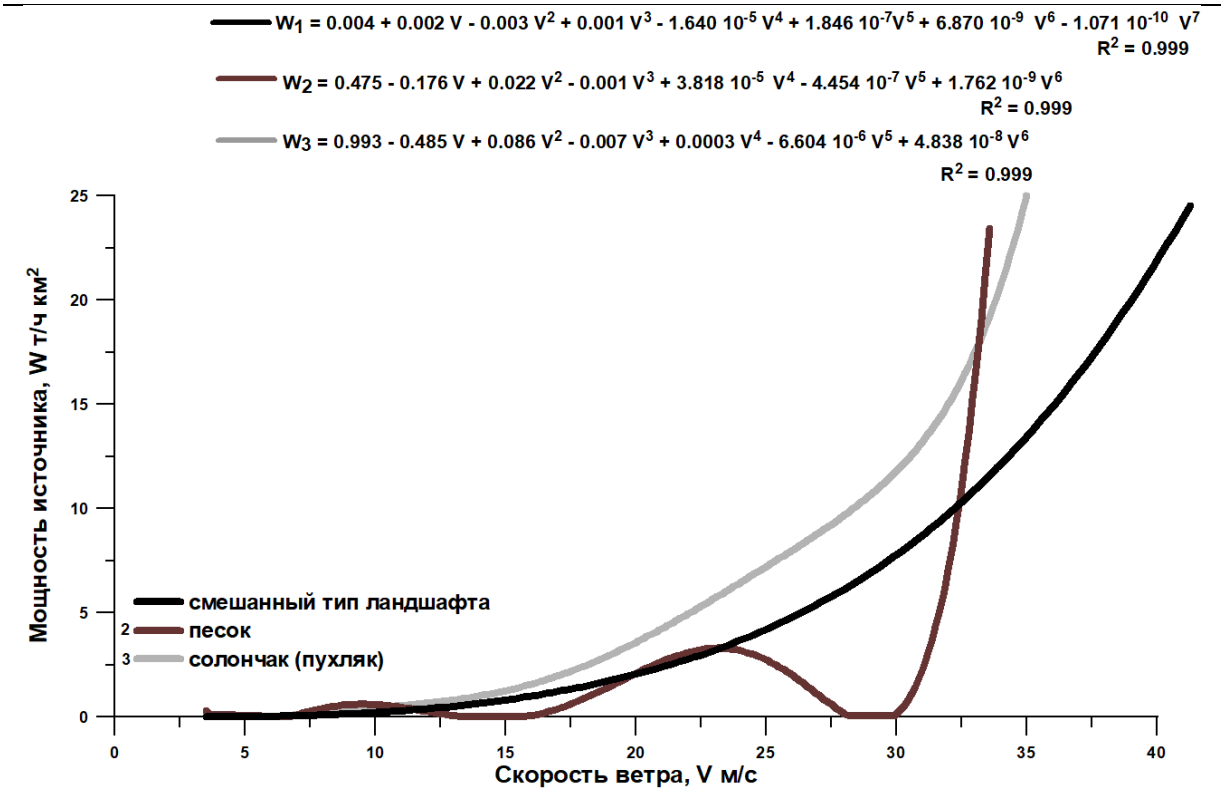


Рис. 3. Потенциальная эмиссионная способность очагов пыльных бурь в пустыне Аралкум в зависимости от типов ландшафта.

Представленные на рис. 3 кривые имеют ярко выраженный нелинейный (экспоненциальный или степенной) характер. Это согласуется с классическими законами аэродинамики, где поток дефляции пропорционален скорости ветра в третьей и выше степени.

Самый низкий порог начала дефляции имеет солончак, который имеет наиболее крутой экспоненциальный рост.

Это объясняется рыхлой, несвязанной структурой верхнего солевого слоя.

Смешанному типу ландшафта характерен умеренный рост объёмов выноса пыли по сравнению с солончаками. Это обусловлено частичной фиксацией поверхности или неоднородностью субстрата.

Наиболее специфический (немонотонный) характер имеет кривая, описывающая зависимость эмиссионной способность песка от скорости ветра. Такой характер кривой, наиболее вероятно, связан с выдуванием тонких фракций пыли из межпесчаных понижений и последующим оголением чистой, более тяжелой песчаной фракции (эффект самобронирования поверхности).

Высокая степень аппроксимации эмпирических данных ($R^2 \approx 1$) позволяет существенно упростить процедуру численного моделирования пространственного распределения шлейфа пыльного выноса в рамках полной трехмерной модели Гаусса [7] за счёт аналитического представления мощности источника как непрерывной функции скорости ветра. В контексте исследования физики развития дефляционных процессов литологическая неоднородность ландшафтных структур параметризуется через порог дефляции – критическую скорость приземного ветра, определяющую момент инициации эолового переноса твердофазных частиц.

Таким образом, в рамках исследования процессов развития пыльных бурь дифференциация ландшафтов определяется порогом дефляции – критической скоростью ветра, инициирующей вынос мелкодисперсных частиц: для песчаных массивов порог дефляции достигается при скорости ветра v = 5-6.5 м/с, что согласуется с данными работы [5]. Начало сальтации песчинок, обладающих относительно большой массой (существенно превышающей массу пылевой фракции), требует значительной кинетической энергии воздушного потока. В свою очередь, солончаки с порогом дефляции v = 4-5 м/с представляют собой более мощный источник аэрозоля. При скоростях ветра $v \geq 15$ м/с происходит разрушение солончаковой корки, вследствие чего эмиссия с этих участков более чем в два раза превышает вынос с песчаных массивов, что обусловлено мобилизацией больших объёмов пыли, аккумулированной под коркой. При ураганном ветре (v > 30 м/с) песок подвергается процессу сплошного влечения, однако его удельная доля в составе пылевого аэрозоля остаётся ниже, чем у солончаковой пыли.

С точки зрения экологических последствий вынос мелкодисперсного материала с солончаков представляет наибольшую опасность, поскольку солончаковая пыль содержит более 60% токсичных солей и пестицидов [15].

Выводы

1. Компенсация дефицита данных лидарного зондирования и стационарного мониторинга на обсохшем дне Аральского моря осуществлена на основе экспедиционных измерений. Экспедиционные работы выполнялись по заблаговременно разработанным маршрутам, охватывающим ключевые типы ландшафтов пустыни Аралкум.

2. Установлено, что при повышенных скоростях ветра массовая концентрация выносимых соле-песчаных частиц диаметром 0.3-10 мкм снижается. Данный эффект обусловлен ускоренным выдуванием мелкодисперсной фракции, преобладанием горизонтальной скорости переноса частиц над скоростью их вертикального подъёма, изменением высоты перемешивания, а также турбулентным осаждением.

3. Инициирование дефляции (процесс страгивания) происходит под воздействием турбулентных потоков, когда сила аэродинамического давления начинает превышать силы сцепления и тяжести частиц. При ураганном ветре выносимый материал приобретает высокую турбулентную энергию, в результате чего аэрозоль переходит в состояние устойчивой суспензии (взвеси).

4. Подтверждено, что солончаки, характеризующиеся более низким порогом дефляции, при штормовом ветре служат значительно более мощным источником аэрозоля по сравнению с песчаными массивами. Это обусловлено разрушением защитной солевой корки и мобилизацией аккумулированного под ней мелкодисперсного субстрата.

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PHYSICS OF DUST STORM PLUME FORMATION FROM A STATIONARY SOURCE IN THE ARALKUM DESERT AND FORECASTING ITS PROPAGATION UNDER SPECIFIED SUMMER WIND REGIMES

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ФИЗИКА ФОРМИРОВАНИЯ ШЛЕЙФА ПЫЛЬНОЙ БУРИ ОТ СТАЦИОНАРНОГО ИСТОЧНИКА В ПУСТЫНЕ АРАЛКУМ И ПРОГНОЗ ЕГО РАСПРОСТРАНЕНИЯ ПРИ ЗАДАННЫХ НАПРАВЛЕНИЯХ ВЕТРА В ЛЕТНИЙ СЕЗОН

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Abstract

This paper examines an empirical model based on the cubic dependence of deflation capacity (W) on wind speed (V), incorporating the threshold velocity for particle lifting (Vo = 5 m/s). To evaluate the spatial distribution of pollution, a modified Gaussian plume dispersion model was applied, accounting for the gravitational settling velocity of particles (Vo = 0,02 m/s) at transport distances up to 1200 km. Absolute deposition rates of sand-salt particles across Uzbekistan were determined for a 24-hour storm cycle. In the near-source zone (Nukus), extreme deposition values reached up to 150 t/km², whereas in remote regions (Tashkent, Fergana, Termez), the deposition density varied between 0.5 and 1.8 t/km². The northwest and north wind directions were identified as the most detrimental to the economy of Uzbekistan, as the dust plumes cover densely populated oases and critical irrigation systems. The proposed methodology enables the development of a «forecast library» containing quantitative estimates of sand-salt pollution scales across Uzbekistan for various wind directions and speeds across different seasons. This provides a scientific rationale for prioritizing the stabilization of the most erosion-prone areas (puffy solonchaks) to minimize salt transport concentrations. Overall, the findings strongly emphasize the necessity of establishing an automated early warning system for dust storm initiation and dynamics based on the methodological approach developed in this study. Vegetative stabilization of puffy solonchaks remains a priority strategy for environmental protection to reduce the soil erosion coefficient (k).

Аннотация

В работе рассмотрена эмпирическая модель кубической зависимости мощности дефляции (W) от скорости ветра (V) с учетом порогового значения подъема частиц (V_o = 5м/с).

Для оценки пространственного распределения загрязнения применена модифицированная Гауссова модель рассеивания шлейфа, учитывающая коэффициент гравитационного оседания частиц (V_o = 0,02 м/с) на расстояниях до 1200 км. Определены абсолютные показатели осаждения соле-песчаных частиц на территории Узбекистана за 24-часовой цикл бури. В ближней зоне (г. Нукус) зафиксированы экстремальные значения – до 150 т/км², в то время как в удалённых регионах (гг. Ташкент, Фергана, Термез) плотность выпадений варьируется от 0,5 до 1,8 т/км².

Установлено, что северо-западное и северное направления ветра наносят наибольший ущерб экономике Узбекистана, поскольку шлейф охватывает густонаселённые оазисы и ирригационные системы. Разработанная методология позволяет сформировать «библиотеку прогнозов», включающую количественные оценки масштабов соле-песчаного загрязнения территории Узбекистана для различных направлений и скоростей ветра по сезонам года. Это позволяет научно обосновать приоритетность закрепления наиболее эрозионно-опасных участков (пухлых солончаков) для минимизации солевого переноса.

Результаты исследования указывают на необходимость создания автоматизированной системы раннего оповещения о начале и динамике пыльных бурь на основе предложенного методологического подхода. Перспективным направлением экологической защиты остаётся фитомелиорация пухлых солончаков для снижения коэффициента эрозии почвы (k).

Keywords: Aralkum, dust storm, deflation, Gaussian plume model, potential capacity, mass concentration, wind speed, soil type.

Ключевые слова: Аралкум, пыльная буря, дефляция, Гауссова модель шлейфа, потенциальная мощность, массовая концентрация, скорость ветра, тип почвы**.**

Введение

Под воздействием антропогенных и естественных факторов на месте обсохшего дна Аральского моря образовалась самая молодая на планете пустыня Аралкум, являющаяся стационарным источником соле-песчаных бурь. Вследствие уникальных физико-географичес-ких условий Центрально-Азиатского региона данный объект стал одним из наиболее активных антропогенно обусловленных источников соле-песчаной эмиссии на планете.

Процесс выноса дисперсных частиц с подстилающей поверхности высохшего дна Аральского моря носит комплексный характер и приводит к формированию шлейфа пыльной бури. Физические механизмы его образования определяются физико-химическими процесса-ми [1], которые включают сальтацию, вертикальный подъем (эмиссию) тонкодисперсной пыли, турбулентную диффузию, а также вариации химического состава аэрозолей в зависимости от сезона года.

Физико-математическое описание формирования шлейфа пыльной бури базируется на балансе между силой гравитации, турбулентным перемешиванием и горизонтальным переносом воздушными массами [2-4].

Таким образом, динамика и устойчивость пылевого шлейфа описываются уравнением адвекции-диффузии с учётом гравитационного осаждения примеси. Ослабление скорости ветра и сопутствующее снижение интенсивности турбулентного перемешивания приводят к деградации шлейфа и седиментации частиц.

В научной литературе представлено значительное количество работ, посвященных разработке математических моделей формирования и трансформации шлейфа пыльной бури. Среди них одной из наиболее востребованных систем для численного моделирования и прогнозирования пространственно-временной динамики концентрации пылевого аэрозоля является модель WRF/Chem (*Weather Research and Forecasting with Chemistry*) [5]. В исследовании [6] проведена оценка применимости модели WRF/Chem для воспроизведения сложных механизмов взаимодействия между аэрозолями, облачностью и радиационным балансом. Авторами продемонстрировано, что интеграция химических и метеорологических процессов в режиме реального времени («*онлайн-сопряжение*») критически важна для точного прогнозирования качества атмосферного воздуха и метеорологических параметров на региональном уровне.

В качестве методологического базиса для прогнозирования распространения шлейфа пыльных бурь, генерируемых стационарным источником в пустыне Аралкум на территории Узбекистана, в данной работе предлагается подход, основанный на принципе «*однократного расчёта для долгосрочного использования*» (*calculate once, use always*). Применительно к прогнозу возникновения и динамики пыльных бурь данный принцип, в отличие от прогнозирования классических метеорологических величин, обоснован тем, что географическое положение и физико-географические характеристики очага (высохшее дно Аральского моря) стационарны, а их временная изменчивость обусловлена исключительно сезонным фактором и типом синоптического процесса. В отличие от традиционного прогноза погоды, где барические системы непрерывно формируются в различных географических точках, в данном случае рассматривается постоянный очаг эмиссии. Это позволяет заблаговременно рассчитать массив возможных сценариев (траекторий и зон покрытия) для различных скоростей, направлений ветра и пороговых значений инициации дефляции, то есть с учётом синоптических процессов Центральной Азии [7,8]. В пользу эффективности предлагаемого подхода свидетельствуют следующие аргументы:

1. **Географическая фиксация:** постоянство координат источника пылевых выбросов позволяет сформировать базу («библиотеку») готовых решений (функций влияния) для фиксированной локации.

2. **Типизация процессов:** поскольку пыльные бури в Центрально-Азиатском регионе обусловлены определенными синоптическими процессами, достаточно провести детальное гидродинамическое моделирование распространения шлейфа для каждого типичного направления и скорости ветра.

3. **Оперативность прогнозирования: в**ероятность генерации пыльной бури определяется наблюдаемыми значениями скорости и направления ветра непосредственно в очаге (пустыня Аралкум). Для прогнозирования её дальнейшего распространения специалисту-прогнозисту не требуется запускать ресурсоемкие математические модели; достаточно оперативно выбрать из базы данных готовый результат, соответствующий текущему синоптическому сценарию.

Следовательно, вариативность параметров шлейфа определяется не стохастическим зарождением очагов, а синоптическим контекстом. Это преобразует задачу динамического прогнозирования в задачу распознавания образов: вместо ресурсоемкого гидродинамического моделирования *в реальном времени*, система использует синоптический детерминизм региона. Заблаговременно рассчитанный массив сценариев («библиотека решений») охватывает весь спектр региональных синоптических траекторий. В момент прогноза функция метеоролога сводится к идентификации текущего синоптического процесса и оперативной инициации соответствующей прекомпилированной карты солепереноса, что критически повышает заблаговременность и точность предупреждений

Целью данного исследования является моделирование пространственного распределения концентрации пылевого аэрозоля, генерируемого стационарным источником в пустыне Аралкум, и прогнозирование траекторий распространения его шлейфа по территории Узбекистана. Расчёт производится на основе заданных значений скорости и направления ветра непосредственно в очаге эмиссии с учётом сезонной изменчивости (в рамках данной статьи детально рассматривается тёплый период года).

Объектом исследования являют-ся песчано-солевые (пылевые) бури, генерируемые очагом эмиссии на высохшем дне Аральского моря (пустыня Аралкум).

Данные и методы расчёта.

Входными параметрами для реализации алгоритма расчёта концентрации пыле-солевого аэрозоля являются дискретные пороговые значения скорости и направления ветра, а также потенциальная эрозионная мощность W [т/(ч·м^2)] источника, определенная по данным натурных (экспедиционных) измерений [9]. Расчёт потенциальной мощности соле-песчаного выноса из очага в пустыне Аралкум для смешанного типа подстилающей поверхности выполняется по формуле:

$$W = k(V - V_o)^3 \quad (1)$$

где V [м/с] – скорость ветра на стандартной метеорологической высоте (высоте анемометра), V_o [м/с] – критическая (пороговая) скорость начала дефляции (для условий пустыни Аралкум $V_o \approx 5$ м/с; $k = 1{,}5 \cdot 10^{-5}$ [т/ч·м^2]·(м/с)) – коэффициент эрозионной способности почв для тёплого периода года. Расчёты проведены для различных градаций скорости ветра (табл. 1) и структурных характеристик почвенного покрова (рис. 1) согласно методике [9].

Таблица 1

Потенциальная мощность W [т/ч· м^2] выноса пыли с пустыни Аралкум для смешанного типа почвы

V м/с	W [т/ч·м^2]	Характеристика ПБ
5	0,0000	Начало дефляции
7	0,0001	Очень слабый вынос
10	0,0019	Слабый вынос
15	0,0150	Интенсивный вынос
20	0,0506	Сильный вынос
25	0,1200	Мощный вынос
32	0,2945	Экстремальный вынос

Метод расчёта концентрации песчано-солевых частиц и распространения пылевого шлейфа от источника в пустыне Аралкум основан на допущении, что профиль концентрации в направлении, перпендикулярном оси ветра, подчиняется закону Гаусса. Концентрация примеси в точке с координатами (x, y, z) рассчитывается по формуле трёхмерной гауссовской модели рассеяния [10]:

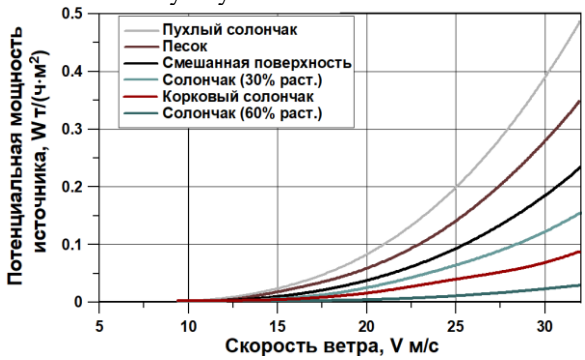

Рис. 1. Зависимость потенциальной мощности пыльных бурь (пустыня Аралкум) от скорости ветра и структуры почвы.

$$C(x,y,z) = \frac{Q}{2\pi\sigma_y\sigma_z V} exp\left(-\frac{y^2}{2\sigma_y^2}\right) \times \left[exp\left(-\frac{(z-H)^2}{2\sigma_z^2}\right) + exp\left(-\frac{(z+H)^2}{2\sigma_z^2}\right)\right]. \quad (2)$$

В (2) $Q = \frac{W \cdot 10^6}{3600}[\text{г/с}]$ – мощность источника, определяемая для единичной площади через заданную потенциальную мощность W; H [м] – эффективная высота источника; член $z+H$ учитывает отражение пыли от поверхности земли; σ_y, σ_z – коэффициенты дисперсии, характеризующие «раздувание» пыльного облака по горизонтали и вертикали по мере удаления от источника x (x_{max} =1200 км). Для нейтрально устойчивой атмосферы (класс «D» по Паскуиллу-Гиффорду [11,12]) σ_y, σ_z определяются по формулам:

$$\left.\begin{aligned}\sigma_y &= 0{,}08(1+0{,}0001\,x)^{-0{,}5}\\ \sigma_z &= 0{,}06(1+0{,}0015\,x)^{-0{,}5}.\end{aligned}\right\} \quad (3)$$

Ширина шлейфа L=4,3σ_y [м] пыльной бури – расстояние y от центральной оси, на котором концентрация достигает порого-вого значения (1% от осевой концент-рации), что соответствует ±2,5σ_y.

Высота шлейфа H_{cl} [м] пылевого облака определяется через дисперсию σ_z: $H_{cl} = 2{,}15\sigma_z$ (10% от приземной концентрации).

Плотность осаждения M_{dep} [т/км^2] за время бури рассчитывается через приземную концентрацию [12] по формуле:

$$M_{dep} = C(x,y,0)\cdot V_s \cdot T \quad (4)$$

$$V_s = \frac{2 \cdot r^2 \cdot g \cdot (\rho_p - \rho_f)}{9 \cdot \eta}$$

где – скорость оседания частиц (закон Стокса), зависящая от диаметра частиц r[м], их плотности ρ_p [кг/м^3], плотности среды ρ [кг/м^3] и динамической вязкости h [Па/с]; g [м/с^2] – ускорение свободного падения.

Для минеральной пыли пустыни Аралкум средний диаметр частиц составляет 10-20 мкм, что соответствует скорости оседания V_s = 0,02 м/с. В (4) T [с] – длительность пыльной бури.

С учётом направления ветра (азимута a) в модели Гауссова шлейфа выполняется преобразование координат из глобальной географической системы в локальную систему координат ветра x^*, y^* согласно азимуту a:

$$x^* = \Delta x\cdot\cos(\theta) + \Delta y\cdot\sin(\theta) \quad (5)$$
$$y^* = \Delta x\cdot\sin(\theta) + \Delta y\cdot\cos(\theta),$$

где $\Delta x = |(j_i - j_{i+1})| \times 111$ [км], $\Delta y = |(L_i - L_{i+1})| \times 111$ [км] – смещение по широте j и долготе L, $\theta = 90^o - (a + 180^o)$.

Тогда, выражение для приземной концентрации в модели Гаусса с учётом направления ветра представится в виде

$$C(x^*, y^*, 0) = \frac{Q}{2\pi\sigma_{y^*}\sigma_{z^*}} \times \exp\left(-\frac{(y^*)^2}{2\sigma^2_{y^*}}\right) \cdot f_d\,(x^*). \quad (6)$$

В (6) множитель $f_d(x^*) = \exp\left(-\frac{V_s \cdot x^*}{V \cdot H}\right)$ – коэффициент истощения шлейфа, отвечающий за убывания массы пыли из воздушного потока по мере удаления от источника.

Анализ результатов

На рис. 2 представлено распределение концентрации соле-песчаных частиц по мере удаления от источника эмиссии при скорости ветра 20 м/с. График демонстрирует глобальный масштаб

рассеяния соле-пылевого шлейфа по двум осям: удалению от источника (x, км) и ширине шлейфа (y, км). Ось Z показывает концентрацию $C\cdot10^2$ мкг/м^3.

В самом источнике и вблизи него наблюдается резкий вертикальный пик. Значение на графике достигает $125\cdot10^2$ мкг/м^3, что соответствует реальной концентрации в 12.5 мг/м^3. Это экстремальный уровень загрязнения, вызывающий практически нулевую видимость.

По мере удаления от Аралкума (x>200 км) концентрация падает нелинейно. На расстоянии приземная концентрация снижается примерно до 2500 мкг/м^3. На максимальном удалении в 1000 км частицы бури все ещё отчётливо фиксируются на уровне около 1000 мкг/м^3, что во много раз превышает среднесуточные нормы ПДК.

Шлейф имеет выраженную гауссову (колоколообразную) форму в поперечном сечении. Максимальная концентрация сосредоточена строго по центральной оси переноса (y=0). По краям шлейфа (на удалении ±100-150 км от оси ветра) концентрация падает практически до нуля, что указывает на чёткие физические границы пылевого фронта.

График «б» на рис. 2 раскрывает вертикальную структуру (z, м) и начальное формирование облака непосредственно у очага опустынивания. При скорости ветра 20 м/с кинетической энергии воздушного потока достаточно, чтобы мгновенно поднять соле-песчаную смесь на высоту до 300-500 м уже в первые 5-10 км от точки выноса. Облако имеет асимметричную каплевидную форму купола. На наветренной стороне (ближе к источнику) происходит лавинообразный подъем массы. Максимальная высота пылевого столба достигается не в самой точке изначального подъёма, а чуть дальше по ходу ветра, где вертикальные турбулентные потоки стабилизируются. В пределах первых 10 км ширина облака (ось y) успевает расшириться примерно на 1.0-1.5 км от центральной оси. Это говорит о мощной горизонтальной турбулентной диффузии, которая раздувает облако вширь с самых первых километров.

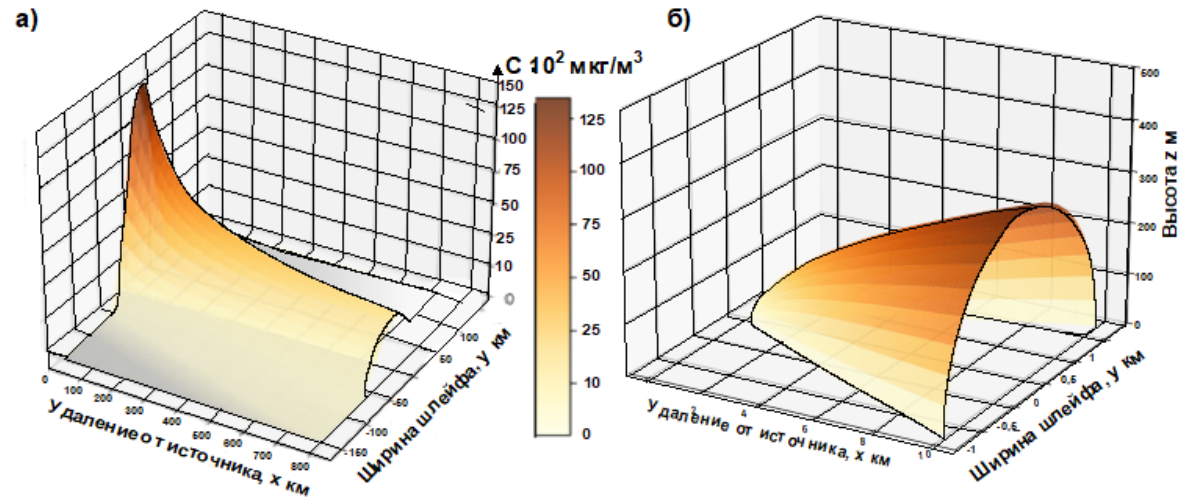

***Рис. 2**. Результаты трёхмерного моделирования рассеяния соле-песчаных частиц при скорости ветра 20 м/с:*
а) пространственное распределение приземной концентрации примеси ($C \cdot 10^2$, мкг/м³) на удалении до 1000 км от источника Аралкум;
б) пространственная геометрия пылевого облака в ближней зоне (до 10 км) с учётом высоты рассеяния (z).

Таким образом, модель доказывает, что при штормовом ветре Аралкум выступает как точечно-линейный сверхмощный источник. Пылевой след без труда преодолевает барьер в 1000 км, сохраняя опасные для здоровья концентрации.

Крутой спад на графике «а» рис. 2 в первые 200 км объясняется выпадением тяжёлых песчаных фракций. Далее (200-1000 км) график переходит в пологий режим – это перенос мелкодисперсной сульфатно-хлоридной соли и ультратонкой пыли, которая не оседает под силой тяжести, а переносится во взвешенном состоянии.

На рис. 3 представлено распределение оседания соле-песчаных частиц при экстремальном сценарии пыльной бури (скорость ветра v=32 м/с, длительность выноса T=24 ч). Как следует из рисунка профиль выпадений соле-песчаных частиц пыльной бури, вызванной штормовым ветром, смещён в сторону средних и дальних дистанций с ростом массы осадка на порядки. Столь значительный диапазон значений плотности осаждения массы частиц в зависимости от расстояния отражает экстремальную пространственную неоднородность процесса, адекватная визуализация которой на едином графике становится возможной лишь при использовании логарифмического масштабирования.

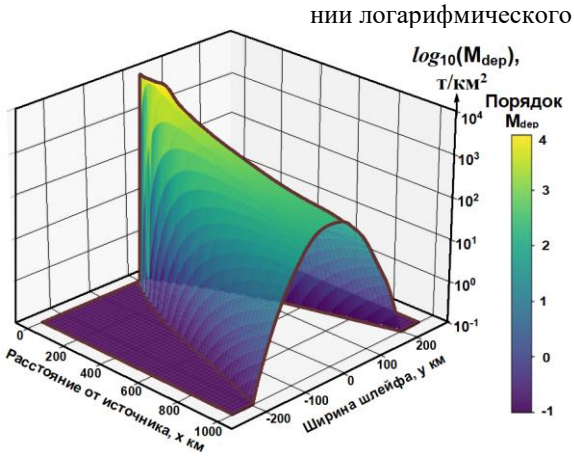

Рис. 3. Зависимость плотности осаждения массы частиц от расстояния до источника эмиссии.

Примечание. Ввиду высокой пространственной гетерогенности осаждения и градиента массы, достигающего нескольких порядков в приэпицентральной зоне, график представлен в логарифмической шкале.

Основную массу поднятого бурей грунта составляют крупные и средние песчаные частицы (диаметром от 100 до 500 мкм и более). Сила тяжести для таких частиц значительно превосходит подъёмную силу турбулентных потоков. Из-за высокой скорости гравитационного осаждения ($v_s \approx$ 0.5 - 3.7 м/с) они выпадают из воздушного потока практически сразу после подъёма, формируя основной объем массы отложений в первые же километры от источника. Здесь основную роль играют механизмы сальтации и качения: крупные частицы песка в очаге дефляции в основном не поднимаются в высокие слои атмосферы. Они перемещаются

скачкообразно (сальтация) или качением по поверхности земли. Пролетев от нескольких метров до сотен метров, они возвращаются на поверхность. Таким образом, огромная доля общей массы перемещаемого твёрдого материала циркулирует и оседает непосредственно внутри или на границе самого очага. По мере удаления от источника пылевой шлейф расширяется по вертикали и горизонтали (процесс турбулентной диффузии). Тот объем частиц, который в очаге был сконцентрирован в узком приземном слое, по мере движения рассеивается в атмосфере. Из-за этого концентрация частиц в кубическом метре воздуха – а значит, и интенсивность их выпадения на землю – падает по экспоненциальному закону по мере удаления от эпицентра.

Таким образом, максимум плотности осаждения в приэпицентральной зоне обусловлен гравитационной сепарацией крупнодисперсных фракций, перемещающихся преимущественно в режиме сальтации, а также максимальной концентрацией примеси в начальной точке факела рассеяния

В рамках концепции инвариантного прогностического моделирования на рис. 4 представлены расчётные схемы пространственного распределения соле-песчаного шлейфа для экстремального сценария развития пыльной бури в летний сезон (источник – пустыня Аралкум). Приведённые карты-сценарии соответствуют различным направлениям ветра, при которых зона осаждения охватывает конкретные административные центры Республики Узбекистан или её столицу – г. Ташкент. Физико-геометричес-кие параметры и расчётные азимуты для рассматриваемых траекторий систематизированы в табл. 2. Указанные значения азимутов соответствуют точным векторам направлений ветра на географические координаты городов, что предполагает учёт естественных флуктуаций и оперативных отклонений воздушных потоков при реальном прогнозировании

Согласно представленным на рис. 4 данным, траектории пылевых бурь, охватывающих 12 административных центров Республики Узбекистан и г. Ташкент, имеют преимущественно северо-западное направление в азимутальном диапазоне 104.7°–142.5°. Плотность осаждения твёрдых частиц в зоне г. Нукуса достигает 100-500 т/км^2, снижаясь в районе г. Бухары до 10 т/км^2. На территорию г. Ташкента проецируется центральная, наиболее устойчивая часть шлейфа с плотностью выпадений порядка 1.5 т/км^2 при площади города S≈330 км^2 суммарная масса осевшей мелкодисперсной солевой смеси составляет около 500 тонн.

Предгорья Тянь-Шаня выступают в роли естественного геоморфологического барьера, обусловливающего аэродинамический застой воздушных масс и формирование экстремально высоких концентраций мелкодисперсных фракций PM2.5. В регионах гг. Джизака и Гулистана удельная масса выпадающей соле-песчаной смеси составляет 5–8 т/км^2, что вследствие высокого содержания сульфатов и хлоридов в составе аралкумского аэрозоля оказывает выраженное деструктивное воздействие на сельскохозяйственные угодья.

При северном векторе переноса в зону интенсивного воздействия попадают территории Республики Каракалпакстан, Хорезмской области, а также сопредельные регионы Туркменистана. Расчётная плотность осаждения соле-песчаных частиц в г. Нукусе составляет 130 т/км^2, в г. Ургенче – около 25 т/км^2. Ввиду пространственной близости к источнику эмиссии (пустыня Аралкум) дисперсный шлейф на данном участке траектории ещё не претерпевает существенного радиального рассеяния, вследствие чего приземная концентрация аэрозольных частиц сохраняется на критическом уровне.

Таблица 2

Характеристики ветра при расчёте запыления административных центров Узбекистана

Областные центры	Координаты, гр.		Направление ветра	Азимут
	широта	долгота		
Андижан	40,791	72,278	Северо-запад.	111,2°
Бухара	39,757	64,453	Северо-запад.	141.2°
Джизак	40,019	67,894	Северо-запад	125.8°
Карши	38,819	65,775	Северо-запад	141.6°
Навои	40,091	65,351	Северо-запад	135,5
Наманган	40,971	71,634	Северо-запад	104,7
Нукус	42,445	59,617	Северный	186,7
Самарканд	39,627	66,959	Северо-запад	131,2
Термез	37,248	67,308	Северо-запад	142,5
Гулистан	40,372	68,777	Северо-запад	118,6
Нурафшан	40,962	69,351	Северо-запад.	116,9
Фергана	40,317	71,785	Северо-запад.	115,4
Ургенч	41,518	60,626	Северный	171,8
Ташкент	41,258	69,239	Северо-запад.	122,3

При западном направлении ветра траектория соле-песчаного шлейфа пролегает вдоль 45° с. ш., пересекая центральную часть пустыни Кызылкум в восточном направлении. Данный сценарий характеризуется наименьшим деструктивным воздействием на агроэкосистемы и крупные административные центры Республики Узбекистан, поскольку основной факел рассеяния смещается вглубь слабозаселённых пустынных территорий.

Северо-восточный вектор ветрового переноса смещает соле-песчаный шлейф в юго-западном направлении, затрагивая преимущественно территорию Республики Каракалпакстан. По сравнению с северной и северо-западной траекториями, данный сценарий характеризуется минимальным социально-экономи-ческим ущербом для региона. Это обусловлено тем, что основной массив мелкодисперсных солевых аэрозолей транслируется на территорию малонаселенного и засушливого плато Устюрт, минимизируя антропогенное воздействие.

Выводы

На основе проведённых теоретических расчётов и математического моделирования динамики дефляции и пространственного переноса соле-песчаного аэрозоля из очага осушённого дна Аральского моря (пустыня Аралкум) получены следующие результаты:

1. **Закономерности ветровой эмиссии**. Потенциальная мощность источника эмиссии определяется нелинейной (кубической) зависимостью от скорости ветра при критическом пороге дефляции 5 м/с. Превышение данного порогового значения обусловливает экспоненциальный рост интенсивности выбросов дисперсного материала в атмосферу.

2. Влияние литологического фактора. Коэффициент эрозионной способности подстилающей поверхности критически зависит от типа почвенного покрова. Установлено, что пухлые солончаки обладают наименьшей связностью и выступают в роли наиболее интенсивных (агрессивных) источников дефляции, обеспечивая максимальный удельный вынос солей.

3. Пространственная дифференциация зон риска. Моделирование траекторий шлейфа при различных метеорологических сценариях позволило классифицировать регионы по степени экологической уязвимости:

а) *Приэпицентральная зона экстремального воздействия:* г. Нукус (азимут 186.7°, удаление 280 км). В условиях ураганного ветра расчётная плотность осаждения достигает максимума – 130 т/км^2.

б). *Среднеудаленная зона:* гг. Ташкент (азимут 122.3°) и Джизак (азимут 125.8°) на расстоянии 700—850 км от источника. Плотность выпадений здесь варьируется в пределах 1.5--3.8 т/км^2.

с). *Зона дальнего трансграничного переноса:* Ферганская долина (азимут 115.4°, удаление более 1000 км). Специфика орографии региона обусловливает консервацию воздушных масс («эффект аэрозольной ловушки»), приводя к седиментации до 0.7 т/км^2 мелкодисперсных солей.

д). *Максимальная протяжённость внутреннего выноса:* г.Термез (азимут 142.5°), где траектория шлейфа сопряжена с рисками вторичного засоления и роста минерализации водных ресурсов в нижнем течении р. Амударья.

4. Оценка потенциального экологического и экономического ущерба. Минимальные деструктивные последствия для агросферы и инфраструктуры фиксируются при северо-восточном векторе ветра (вынос на малонаселённое плато Устюрт) и западном переносе (транзит над пустыней Кызылкум в южные регионы Казахстана). Максимальный ущерб ассоциирован с северным и северо-западным направлениями ветра, при которых зоны седиментации перекрывают густонаселенные оазисы (Хорезмский, Бухарский, Ташкентский) и Ферганскую долину.

5. Практическая значимость и рекомендации. Результаты пространственно-временного моделирования обосновывают высокую эффективность разработанной в статье методологии оперативного прогнозирования, базирующейся на принципе формирования инвариантных расчётных матриц сценариев. Предложенный подход, реализующий концепцию статических априорных вычислений, позволяет исключить необходимость трудоёмкого динамического моделирования в реальном времени. Процесс прогнозирования сводится к экспресс-сопоставлению текущих синоптических параметров (прогнозных азимутов ветра) с фиксированной базой данных расчётных шлейфов и цифровой картой ландшафтных типов поверхностей Аралкума. Данный метод рекомендуется к интеграции в автоматизированные системы раннего оповещения национальных метеослужб. При этом стратегическим вектором долгосрочной экологической защиты региона остаётся фитомелиорация пухлых солончаков Аралкума для снижения коэффициента эрозионной способности почвы.

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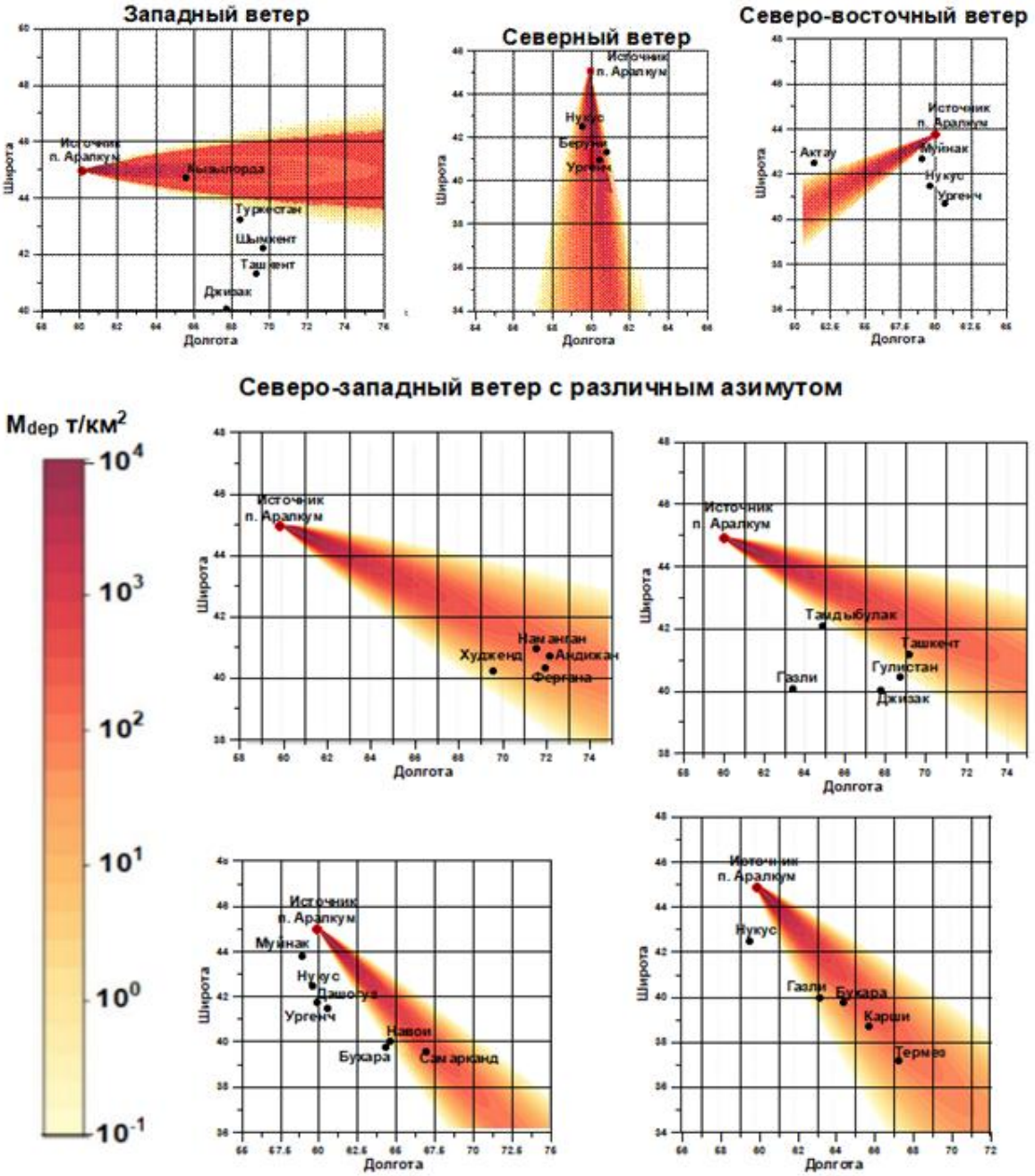

Рис. 4. Пространственное распределение плотности осаждения массы соле-песчаных частиц при различных векторах ветрового переноса из источника пустыни Аралкум.

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ECONOMIC SCIENCES

UNEVEN REGIONAL DEVELOPMENT AS A SIGNIFICANT CHALLENGE AMONG GEORGIA'S SOCIO-ECONOMIC PROBLEMS

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Abstract

A significant part of the country's socio-economic development challenges is focused on addressing the existing inequalities and disparities between regions. The uneven development of territorial-administrative units in Georgia and the diversity of socio-economic problems are a 'legacy' of the Soviet economic system. After gaining independence, the management and planning of territorial units, along with a number of other reforms, were poorly implemented. As a result of these mistakes, the economic development inequalities between regions deepened and became more pronounced. To the existing socio-economic problems were added entirely new ethnic conflicts and separatist movements, encouraged and „suggested“ by external forces… In the 1990s, these events significantly worsened the socio-economic situation of several regions. The problem became widespread, giving rise to depressed, crisis-stricken, and conflict-affected territories. As a result of the August 2008 Russia-Georgia war, the problems further intensified, and the socio-economic and political life of several regions became significantly more complicated. Terms such as: occupied, border’ strategic, and potentially dangerous territories have been used for some time. To overcome the existing problem, the country's strategic development programs need to pay particular and greater attention to the main and targeted measures aimed at 'mitigating' the causes of inequality among territorial-administrative units. It is essential not only to identify the problems but also to resolve them and eliminate them in a short period of time. Regional development inequalities have a significant impact on the country's economic growth and, consequently, on its economic development indicators. Alongside local-territorial capacities, the country's national values, as well as geopolitical developments and changes, must be taken into account.

Keywords: regional inequality, economic growth and development of regions, government programs for regional development.

Considerable successful experience has been accumulated worldwide regarding the effective management of countries' territorial-administrative units. It should also be noted that, alongside the abundance of successful models, certain specific characteristics must be taken into account when addressing the problems of each particular region. A successful model cannot be universally applied like a 'recipe,' because the main and decisive factor for development is the country's real capacities: natural conditions, geographical-territorial characteristics, and the specific features of its historical, cultural, economic, and entrepreneurial environment. Accordingly, within a region, as a territorial part of the country, there cannot be trends and challenges that are sharply different from the country's overall economic development. "By optimally aligning the development of each region (territory) with the overall state objectives, a unified process of mutual interests is formed, creating an environment that facilitates the achievement of national goals" (Grdzelishvili, 2020, p. 44). That is precisely why the economic growth and development of territorial-administrative units is inconceivable without the full-scale development of the country. Accordingly, the main directions and challenges of this process are reflected in the government programs for regional development of the country, which are shaped into targeted development programs for each region. It serves as one of the important and primary instruments for accomplishing the main objective. The pronounced disparities between regions are the result of problems accumulated over many years, originating from the socialist economic system. Eliminating the underlying causes is not an easy task, as they have developed over a long period. Over time, a foundation was laid for the strengthening of individual regions (territories), which was accompanied by numerous negative consequences:

1. During the socialist economic system, the concentration and clustering of enterprises mostly occurred in large industrial cities, particularly in Tbilisi.
2. „The formation of “mono-cities,” based solely on the development of one or two sectors, made the entire economic progress of these cities dependent on them.
3. A general economic crisis, which is also distinguished by regional particularities.
4. Changes in the country's geopolitical location (Gdzelishvili, 2020, p. 220).

For Georgia, stable economic growth, and consequently economic development, is a key objective, which is directly affected by the pronounced disparities and disproportions between regions. Over the past decade (since 2014), entirely new challenges and obligations have emerged following the signing of the Association Agreement with the European Union, which is linked to the introduction of new norms, standards, and

regulations in the country. The priority issues for addressing regional problems are considered to be: the development of scientifically grounded socio-economic development programs for regions with self-sufficient households, which, based on existing potential, can maximize the full utilization of resources; the establishment of close reproductive linkages between existing sectors and enterprises in the region; the rational use of all major resources maintained through coordinated actions of structural units across various sectors; and the formation of territorial entities with social priorities, taking into account the economic and geographical potential.

A significant change in the current situation will occur only if the state primarily shifts its attention to regional issues. It should be noted that a region cannot tackle severe socio-economic problems on its own. On the contrary, over time, due to difficult social conditions, unemployment, insufficient job opportunities, and a range of other problems, addressing the issues of territories depleted of young generations faces numerous obstacles. It is impossible to substantially resolve the problems through small-scale proposed social programs and packages. Unfortunately, against this backdrop, the number of lagging, crisis-affected, and depressed regions in the country is increasing. They are characterized by underdeveloped infrastructure and a lack of social service provisions. The disparities present in the regions have their own underlying factors and causes. The greatest problem is unemployment, which directly affects income and, consequently, the standard of living. A comparison of the distribution of gross domestic product (GDP) and unemployment rates across the country's regions clearly reveals the differences and inequalities between them.

Table 1

Distribution of Gross Domestic Product (GDP) (million GEL) By Regions of Georgia

Regions of Georgia	2014 (year)	2024 (year)
Tbilisi	14,155.40	42,982.60
Samegrelo-Zemo Svaneti	1,737.20	4,441.80
Racha-Lechkhumi, Kvemo Svaneti	138, 6	476,8
Imereti	2,265.10	6,270.60
Guria	544,2	1,357.40
Autonomous Republic of Adjara	2,325.10	7,516.20
Samtskhe-Javakheti	1,118.10	2,485.80
Shida Kartli	1,513.70	3,414.90
Kvemo Kartli	2,060.90	5,778.70
Mtskheta Mtianeti	677,8	2,216.20
Kakheti	1, 546.10	4,038.50
Georgia	28,082.10	80,979.40

Table 2

Unemployment rate (%) By regions of Georgia

Regions of Georgia	2014 (year)	2024 (year)
Tbilisi	22,4	14,9
Samegrelo-Zemo Svaneti	24,9	10,5
Racha-Lechkhumi, Kvemo Svaneti	17	11, 6
Imereti	22,5	17,3
Guria	20,0	16,3
Autonomous Republic of Adjara	38,6	11,3
Samtskhe-Javakheti	10,5	7,7
Shida Kartli	20	14,3
Kvemo Kartli	15,3	16,7
Mtskheta Mtianeti	16,3	13,6
Kakheti	19,6	10,2
Georgia	23	13,9

Source: National Statistics Office of Georgia

Georgia is a small country, but its regions differ sharply in a number of characteristics, which over time has been reflected in the development of their structures. During the transitional period to a market economy, the prolonged process highlighted and even deepened many problems. Over the years, biases, influences, lobbying, governmental "favoritism" toward certain regions, and their exceptional status became evident in the allocation of financial resources. In our view, in order to mitigate the existing disproportions and unequal outcomes, it is necessary, when allocating funding, to:

- Promote the interests of the regions, prioritizing them and providing appropriate financial support, targeting funding, and establishing specific directions
- Find long-term and stable financial sources
- Identify specific regional investment projects and continuously monitoring their financial support
- Take into account regional characteristics and specificities during the implementation of reforms, and

ensuring equal conditions when carrying out investment activities

Despite the significant work carried out in recent years, many problems have accumulated, accompanied by a number of challenges and difficulties. An unstable political environment negatively affects the development of several regions, with most of them still largely dependent on local resources and sources of funding. The targeting, effectiveness, purpose, and directions of the investments made are not fully monitored. In many regions, investments and appropriate funding are still allocated only in particularly severe cases.

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REFORMING AND REGULATING THE DEPOSIT INSURANCE SYSTEM IN GEORGIA

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Abstract

The reform, regulation and further improvement of the deposit insurance system is an important proven mechanism for protecting depositors and, accordingly, the banking sector and maintaining the stability of the country's financial system. It allows for its effective management capabilities and ensures the protection of the financial market from various risks related to strengthening the financial security system of the state and the private sector, protecting depositors and preventing systemic crises in the banking sector.

The paper analyzes the further stages of the reform and regulation of deposit insurance in Georgia, its economic and financial impact and risk management mechanisms.

Keywords: 1. Deposit insurance; 2. Investment portfolio; 3. Financial stability; 4. System reform; 5. Risk management.

Introduction: The reform of the deposit insurance system in Georgia was carried out taking into account international principles, international practice, World Bank recommendations and the Association Agreement between Georgia and the European Union. For its effective functioning, it is important that the insurance margin is precisely defined and creates an appropriate guarantee of protection. The gradual increase in the insurance margin and its approximation to European standards is an important priority, and according to the basic principles of deposit insurance and best international practice, an increase in the margin is appropriate when the financial situation is sustainable and the banking sector is stable. In 2025, a combination of economic and financial progress was created, which created another prerequisite for the possibility of further increasing the insurance margin, so that the effect of the decision would be as painless as possible for commercial banks in terms of financial impact. Taking into account all of the above, starting from 2026, the size of the margin will be increased from 30,000 to 50,000 GEL. Further reform and regulation of the deposit insurance investment portfolio, its investment policy and management in Georgia can be achieved by developing a coherent and systematic strategy for the deposit insurance system.

Methodology: The paper covers the stages of further reform and regulation of the deposit insurance system portfolio in Georgia, risk management and its compliance with financial market requirements, and stages of development and regulation in Georgia.

Review: Deposit insurance and deposit insurance portfolio regulation in Georgia, which is based on the principles of safety, liquidity and diversification, has been introduced over the past eight years and continues to develop to this day. For the proper functioning of the deposit insurance system, it is important to correctly determine the insurance threshold and create an adequate guarantee of protection. According to the European Union standard, the insurance threshold is 100,000 euros, which is still an unrealistic indicator for the reality of Georgia. In Georgia, the insurance threshold of the deposit insurance system at the first stage was 5,000 GEL for individuals, and at the second stage, starting in 2020, this threshold increased to 15,000 GEL. At the same stage, an important innovation was implemented with a view to the country's socio-economic development, and from 2022, insurance of legal entities was added to the system. This approach has led to even closer alignment with international practice, and the amount of insured deposits has increased by an average of 500 million GEL. In the third stage, starting in 2024, the deposit insurance limit has doubled to 30,000 GEL. Starting from April 1, 2026, in the fourth stage, the deposit insurance system is expanding again. The amount of the insured deposit of individuals and legal entities has increased from 30,000 GEL to 50,000 GEL. As of today, the amount of money available in all accounts of all depositors in commercial banks and micro banks is automatically insured without additional fees. This is the third time the limit has been increased.

The Deposit Insurance Supervisory Authority, guided by the international deposit insurance standards established by the Bank for International Settlements (BIS) and the core principles of the International Association of Deposit Insurance (IADI), ensures the reform of the investment policy of the deposit insurance risk portfolio, the functioning of a stable financial environment, the solution of the tasks facing the system and the promotion of its further development. It introduces the latest international and European trends in deposit insurance and formulates medium-term strategic plans taking into account the following main credit, liquidity, market, currency and operational risks.

As of today, the Georgian financial system is quite resilient and stable. In turn, the banking system is highly capitalized, liquid and profitable, which critically needs to protect financial security. As of 2025, a total of 19 members are involved in the deposit insurance system in Georgia, including 17 commercial banks (three of which are digital banks) and 2 micro

banks. The two largest of them, whose total assets account for more than 70% of the banking system, are listed on the London Stock Exchange. The banking system maintains a high level of capitalization, which contributes to the stability of the sector. The capital growth resource is positively assessed, both in terms of shareholder strength and profitability. The stability of the banking sector is also indicated by the loan portfolio, and it can be said that banks maintain an adequate level of liquid assets corresponding to the structure of liabilities.

Based on data for 2018-2025, the sharpest increase in insured deposits was recorded at the end of 2020, at 100.36%, which was associated with the increase in the insurance limit from 5,000 GEL to 15,000 GEL in 2020. The 29.88% increase in 2022 was due to the addition of legal entities. As of December 31, 2025, the volume of total deposits increased by 13.85% compared to the corresponding period of the previous year, of which deposits of individuals increased by 12.87%, and deposits of legal entities by 14.95%. For the same period, the total volume of insured deposits (individuals and legal entities) amounted to 12.25 billion GEL, of which 11.24 billion GEL were insured deposits of individuals, and 1.007 billion GEL were insured deposits of legal entities. In 2025, total insured deposits increased by 14.75% annually, insured deposits of individuals by 15.51%, and insured deposits of legal entities by 6.88%. For 2018-2025, the total volume and change of insured deposits of individuals and legal entities looks like this: Table N1

Table №1

Total volume of insured deposits of individuals and legal entities by year, (billion GEL) and change (%) 2018-2025.

Year	2018	2019	2020	2021	2022	2023	2024	2025
Total Deposits	23.90	27.24	35.42	38.03	46.03	52.09	60,29	68.64
Change%		13.97	30.01	7.38	21.04	13.15	15.75	13.85
Deposits of Individuals	12.50	15.07	18.49	20.29	24.00	27.33	31.85	35.95
Change%		20.53	22.70	9.74	18.27	13.90	16.52	12.87
Deposits of Legal Entities	11.40	12.17	16.93	17.74	22.03	24.75	28.44	32.70
Change%		6.75	39.11	4.78	24.20	12.33	14.91	14.95
Total Insured Deposits	1.75	2.02	4.04	4.56	5.92	6.86	10.67	12.25
Change%		15.25	100.36	12.72	29.88	15.99	55.50	14.75

In 2025, 73,159,034 GEL was accumulated in the Deposit Insurance Fund as regular insurance contributions by commercial banks. Income received in the form of coupons and from funds placed on overnight deposits with the National Bank of Georgia amounted to 26,752,054 GEL and 597,722 GEL, respectively. Income received from primary contributions amounted to 200,000 GEL, and other income amounted to 40,000 GEL. The income of the Deposit Insurance Fund in 2017-2025 looks like this: Table N2

Table №2

Income of the Deposit Insurance Fund in 2017-2025

Year	Initial contribution	Regular insurance contribution	Daily benefit	Coupon	Other income	Total income
2017	1,600,000	0	0	0	0	1,600,000
2018	0	13,843,674	0	349,391	0	14,193,065
2019	0	16,787,385	0	1,541,832	0	18,329,218
2020	0	22,687,212	0	3,436,201	0	26,123,412
2021	0	30,674,444	0	5,229,436	0	35,903,880
2022	100,000	37,678,392	561,955	8,477,992	0	46,818,339
2023	100,000	42,393,708	1,543,994	13,101,777	0	57,139,479
2024	100,000	64,264,041	713,936	19,651,700	26.317	84,755,955
2025	200,000	73,159,034	597,722	26,752,054	40,000	100,748,810
Total	2,100,000	301,487,889	3,417,608	78,540,383	66.317	385,612,197

As of December 2025, 97% of depositors are fully insured, while 89% of legal entities are fully insured. 57% of insured deposits of individuals are insured in national currency, and 43% in foreign currency. In the case of insured deposits of legal entities, 78% of insured deposits are insured in national currency, and 22% in foreign currency. In terms of total insured deposits, these figures are 59% and 41%, respectively.

Currently, in order to maintain the security and liquidity of the Deposit Insurance Fund, funds are invested only in low-risk assets, treasury securities. The agency also places free funds in an overnight deposit account at the National Bank of Georgia, where the annual interest rate is determined by the monetary policy rate.

Conclusion: Deposit and depositor insurance is one of the most important components and a continuously developing strategic process, on which the stability of the banking sector and the effective functioning of other financial institutions significantly depend, which can be achieved by developing a consistent and systematic strategy for the deposit insurance system

and its further reform, taking into account the basic principles of the International Deposit Insurance Association and the requirements set out in European directives.

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MANAGING INNOVATION ACTIVITY OF SMALL AND MEDIUM-SIZED BUSINESSES IN THE CONTEXT OF DIGITAL TRANSFORMATION OF THE ECONOMY

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Abstract

The article examines the theoretical and practical aspects of managing the innovation activity of small and medium-sized businesses in the context of the digital transformation of the economy. The relevance of the research is due to the increasing role of small and medium-sized enterprises in providing employment, diversifying the economy, developing the domestic market and creating an innovative environment. The materials of the Republic of Kazakhstan show that the SME sector is a significant element of the national economy: as of January 1, 2025, 2,262.4 thousand were registered in the country. There were 2,071.7 thousand SMEs, of which 2,071.7 thousand were active; the number of people employed in the sector reached 4,422.1 thousand people, and output in 2024 amounted to 81,920.0 billion tenge [1]. At the same time, the level of innovative activity of enterprises remains insufficiently high and, according to official statistics, amounted to about 11.9% in 2024 [3]. This indicates that there is a gap between the scale of the business sector and its ability to systematically implement technological, organizational and marketing innovations. The article substantiates the need to move from fragmented implementation of digital solutions to a comprehensive innovation management model that includes digital infrastructure, access to finance, competence development, platform integration and institutional support.

Keywords: small and medium-sized businesses, innovation activity, digital transformation, entrepreneurship, digital platforms, Kazakhstan, innovation management.

Introduction. In modern conditions, digital transformation is becoming one of the key factors in increasing the competitiveness of the national economy. The development of digital technologies, electronic commerce, artificial intelligence, big data, cloud services, and platform-based business models is changing traditional approaches to organizing entrepreneurial activity. This process is especially important for small and medium-sized businesses, as SMEs have high flexibility, the ability to quickly adapt to changes in demand, and the potential to introduce new products, services, and business processes.

For Kazakhstan, the problem of managing the innovation activity of SMEs is of particular relevance. On the one hand, small and medium-sized businesses demonstrate steady quantitative growth. According to the Bureau of National Statistics of the Republic of Kazakhstan, as of January 1, 2025, the number of registered SMEs amounted to 2,262.4 thousand units, which is 3.8% more than on the same date in 2024. The number of operating SMEs reached 2,071,700 units, an increase of 3.5% [1]. On the other hand, the innovative activity of enterprises remains limited, which hinders the transition of SMEs from extensive growth to high-quality development.

The digital transformation of the economy creates new opportunities for small and medium-sized businesses: expanding sales markets through e-commerce, reducing transaction costs, automating management processes, using digital marketing, implementing CRM and ERP systems, developing fintech tools and platform interaction with consumers. In 2025, the volume of retail electronic commerce in Kazakhstan, including marketplaces, amounted to 3,768.8 billion tenge, and its share in the total retail trade reached 14.3% [2]. This shows that digital channels are becoming not an auxiliary, but an independent direction for the development of entrepreneurial activity.

The purpose of the article is to study the features of managing the innovative activity of small and medium-sized businesses in the context of the digital transformation of the economy and to develop ways to increase the effectiveness of innovative development of SMEs.

Literature review. In the scientific literature, the innovative activity of business entities is considered as the ability of enterprises to create, adapt and implement new products, technologies, organizational solutions and methods of promotion. According to the classical approach of J. Schumpeter, innovations are the basis of entrepreneurial development and act as a source of economic dynamics [8]. In modern conditions, this idea takes on new content, as innovations are increasingly associated not only with industrial technologies, but also with digital platforms, data, algorithms, service models and network effects.

International studies show that the digital transformation of SMEs depends not only on the availability of technology, but also on managerial competencies, organizational culture, access to finance, and the ability of enterprises to use data for decision-making [9]. Small and medium-sized businesses are characterized by limited financial and human resources, so innovation often takes place not through large research units,

but through the gradual adaptation of ready-made digital solutions: online sales, mobile payments, cloud services, CRM systems, digital analytics and automated accounting.

In Kazakhstan, the issues of digitalization of entrepreneurship are considered in the context of the state policy on the development of the digital economy. International ratings show a certain progress of the country in the field of digital governance. In particular, Kazakhstan ranked 24th among 193 countries in the UN e-Government Development Index in 2024 [5]. This creates favorable institutional conditions for the development of digital services, however, a high level of digitalization of public services does not always automatically translate into high innovation activity of the private sector.

According to WIPO, Kazakhstan ranked 81st in the Global Innovation Index among 139 economies in 2025 [6]. This indicator indicates the need to strengthen the national innovation system, especially in terms of technology commercialization, research and development, increasing the digital maturity of enterprises and stimulating innovation in the SME sector.

Materials and methods of research. The methodological basis of the article consists of systematic, comparative, statistical and analytical approaches. Data from the Bureau of National Statistics of the Republic of Kazakhstan, the World Bank, the United Nations, WIPO, Network Readiness Index, as well as scientific publications on innovation management and digital transformation of small and medium-sized businesses were used as an information base.

The study was conducted in several stages.

At the first stage, the role of SMEs in the Kazakh economy was analyzed based on indicators of the number of registered and operating entities, the number of employees, output and contribution to GDP.

At the second stage, the indicators of digital transformation were considered, including the development of e-commerce, the use of marketplaces, the expansion of digital infrastructure and Kazakhstan's position in international digital ratings.

At the third stage, an assessment of the problems of managing the innovation activity of SMEs was given and directions for its improvement were proposed.

The following indicators were used for the analysis:

1. the number of registered and active SMEs;
2. the number of people employed in the SME sector;
3. Production by SMEs;
4. the share of SMEs in GDP;
5. E-commerce volume;
6. the share of e-commerce in retail turnover;
7. the level of innovative activity of enterprises;
8. Kazakhstan's position in the international indices of digital and innovative development.

The results of the study. The analysis shows that small and medium-sized businesses occupy a stable and growing place in the economic system of Kazakhstan, acting simultaneously as a source of employment, entrepreneurial initiative, product output and potential basis for innovative development. According to the Bureau of National Statistics of the Republic of Kazakhstan, as of January 1, 2025, 2,262,392 small and medium-sized businesses were registered in the country, while on the same date in 2024 their number was 2,178,951 units. Thus, during the period under review, the number of registered SMEs increased by 83,441 units, or 3.8% [1]. This dynamic indicates the continued positive entrepreneurial activity, despite structural constraints related to access to finance, the level of digital maturity, and the heterogeneity of the regional business environment.

Simultaneously with the growth of the total number of registered entities, there is an increase in the number of actually operating enterprises. As of January 1, 2025, the number of operating SMEs amounted to 2,071,657 units, which is 69,458 units, or 3.5% more than on January 1, 2024 [1]. The share of operating entities in the total number of registered SMEs has reached 91.6%, which suggests a fairly high degree of involvement of business structures in economic activity. At the same time, the quantitative expansion of the sector does not always mean qualitative growth, since innovation activity depends not only on the number of enterprises, but also on their ability to implement new technologies, management solutions, digital tools and modern business models.

Table 1

Key indicators of SME development in Kazakhstan

Indicator	2024 / as of 01.01.2024	2025 / as of 01.01.2025	Change
Registered SMEs, units	2 178 951	2 262 392	+3,8%
Operating entities of SMEs, units	2 002 199	2 071 657	+3,5%
Employed in SMEs, people	4 326 316	4 422 058	+2,2%
SME output, billion tenge	68 710,5	81 920,0	+11,5%
The share of SMEs in GDP, January–September 2024	-	39,3%	+2,8 п.п.
Note - compiled according to [1].			

The importance of small and medium-sized businesses is manifested not only in the quantitative growth of subjects, but also in its contribution to employment. The number of people employed in the SME sector as of January 1, 2025 amounted to 4,422.1 thousand people, which is 2.2% higher than in the previous year [1]. This confirms the socio-economic role of SMEs as one of the key mechanisms for creating jobs and maintaining household incomes. At the same time, the growth of employment in the SME sector in the context of digital transformation acquires a new content: there is an increasing need not only for traditional labor resources, but also for specialists with digital competencies,

online sales tools, data analytics, automated accounting, digital marketing and customer service management.

The economic contribution of SMEs is also characterized by a positive dynamics. The output of small and medium-sized enterprises in January–December 2024 amounted to 81,920.0 billion tenge, an increase of 11.5% compared to the previous year [1]. This growth indicates the expansion of the manufacturing and service activity of the enterprise sector. At the same time, to ensure the long-term sustainability of the economy, it is important that an increase in output is accompanied not only by an increase in volumes, but also by technological upgrades, increased productivity, the introduction of digital solutions and the transition to more complex forms of value creation.

The digital transformation of the business environment is of particular importance in the context of innovation management. One of the most visible indicators of the digitalization of SMEs is the development of e-commerce. According to official statistics, the volume of retail e-commerce in Kazakhstan, including marketplaces, in 2025 amounted to 3,768.8 billion tenge, whereas in 2021 this figure was 482.0 billion tenge [2]. Consequently, in 2021-2025, the volume of retail e-commerce increased almost 7.8 times. This dynamic indicates an accelerated expansion of digital sales channels and the formation of new models of interaction between businesses and consumers.

Table 2

Dynamics of electronic commerce in Kazakhstan

Indicator	2021	2022	2023	2024	2025
The volume of retail electronic commerce, billion tenge	482,0	1 963,5	2 439,8	3 156,4	3 768,8
The share of e-commerce in retail trade, %	3,6	12,5	12,7	14,1	14,3
Volume of e-commerce services, billion tenge	349,9	1 186,5	1 602,6	2 443,4	2 477,3
Note - compiled according to [2].					

The growth of e-commerce reflects not only a change in consumer behavior, but also a transformation in the management practices of SMEs. For small and medium-sized enterprises, digital sales channels are becoming a tool for expanding the market, reducing transaction costs, optimizing logistics, improving communication with customers and increasing the speed of order processing. If earlier the digitalization of entrepreneurship was often perceived as an auxiliary element of promotion, now it becomes part of the innovative strategy of the enterprise.

Marketplaces play a particularly significant role in the development of digital entrepreneurship. In 2025, marketplaces accounted for 86% of the retail e-commerce volume, while enterprises' own Internet resources accounted for 14% [2]. This shows that platform solutions have become the most accessible channel for small and medium-sized businesses to enter the digital market. Marketplaces provide entrepreneurs with access to a wide consumer audience, payment infrastructure, logistics services, and promotion tools. At the same time, high dependence on external platforms creates certain management risks associated with limited control over customer data, commission costs, dependence on platform rules and reduced independence in brand formation. In this regard, effective management of SME innovation activity should include not only the use of marketplaces, but also the development of its own digital channels, customer bases, loyalty systems and sales analytics.

The development of digital commerce and the platform economy requires an appropriate infrastructure base. For SMEs, access to high-quality Internet, digital payment systems, cloud services and logistics solutions is a prerequisite for the implementation of innovations. In this regard, it is important to expand the digital infrastructure in the regions, since it is precisely regional differences in access to technology that limit the uniform development of innovative entrepreneurship. The financing of the Kazakhstan Digital Acceleration for an Inclusive Economy project, aimed at expanding broadband access in underserved regions of the country, indicates the recognition of digital infrastructure as one of the key conditions for economic integration and entrepreneurship development [4].

Despite the positive dynamics of digitalization, the level of innovative activity of enterprises in Kazakhstan remains insufficiently high. According to official statistics, in 2024, the innovative activity of enterprises was about 11.9% [3]. This means that only a limited number of enterprises systematically implement product, process, organizational or marketing innovations. Consequently, there is a significant gap between the scale of the SME sector and the level of its innovative involvement. This gap is explained by a number of factors, including limited access to financing for innovative projects, a lack of digital competencies, weak integration of science and business, low willingness of enterprises to manage data, and the fragmented nature of digital technology adoption.

In practice, many SMEs use digital tools primarily for individual operations, for example, to promote goods on social networks, accept online orders, or work through marketplaces. However, more complex elements of digital transformation, including CRM systems, ERP solutions, big data analytics, warehouse accounting automation, demand forecasting, and the use of artificial intelligence, remain less common. This indicates that the innovative activity of SMEs should be considered not only as a result of the introduction of individual technologies, but also as a controlled process of organizational development.

In this regard, the management of innovation activity of small and medium-sized businesses should be based on an integrated model combining strategic planning, digital technologies, financial instruments, human

capital development and institutional support. An enterprise's innovation strategy should include defining digitalization goals, evaluating resources, selecting priority technologies, calculating the expected effect, and monitoring the results. Only with such a strategy can digital transformation move from the elemental implementation of individual solutions to the systematic management of innovative development.

Table 3

The SME Innovation Activity management model

The model element	Content	Expected effect
Innovative strategy	Goals, indicators, and an innovation plan	The transition from random digitalization to system management
Digital technologies	CRM, ERP, e-commerce, Big Data, AI, cloud services	Cost reduction, sales growth, improved quality of solutions
Financing	Grants, preferential loans, guarantees, digital vouchers	Increasing the availability of innovative projects
Competencies	Training of entrepreneurs and employees	The growth of digital maturity of SMEs
and the institutional environment	Technology parks, accelerators, infrastructure, IP protection	Formation of an innovation ecosystem
Note - compiled by the author.		

The presented model shows that the innovative activity of SMEs is formed under the influence of not one, but a combination of interrelated factors. Digital technologies create an instrumental basis for innovation, but their effectiveness depends on financial accessibility, staff qualifications, managerial readiness of the enterprise and the quality of the institutional environment. Therefore, measures to support SMEs should be aimed not only at subsidizing individual costs, but also at creating a sustainable innovation ecosystem.

An important area of increasing innovation activity is the development of digital maturity of enterprises. This requires the introduction of diagnostic tools that allow assessing the degree of digitalization of a business by such parameters as online sales, automated accounting, the use of CRM systems, digital marketing, data analytics, information security and integration with platforms. Such diagnostics will make it possible to identify the real needs of enterprises and form targeted support measures.

An equally important area is the expansion of SMEs' access to digital finance. The use of fintech tools, scoring models, digital applications, and alternative data can increase the availability of loans and grants for innovative projects. This is especially important for start-up entrepreneurs, companies from the regions and enterprises that do not have sufficient collateral. At the same time, financial support should be linked to specific results of digitalization: software implementation, automation of processes, entry into new markets, increased productivity and sales growth.

Thus, the results of the study confirm that digital transformation creates significant opportunities for increasing the innovative activity of small and medium-sized businesses. However, the realization of these opportunities requires a transition from the fragmented use of digital tools to the systematic management of innovative development. This is especially important for Kazakhstan, as the SME sector already has a significant economic scale, but its innovative potential is not yet fully exploited. Increasing the innovative activity of SMEs should become one of the key directions of state economic policy, regional development and entrepreneurial strategies in the digital economy.

Discussion. The results of the study show that Kazakhstan has significant entrepreneurial potential, but the innovation activity of SMEs does not yet correspond to the scale of the sector. On the one hand, there is an increase in the number of operating SME entities in the country, an increase in employment and an expansion in output. On the other hand, the innovation activity of enterprises remains at about 11.9%, which indicates the need to strengthen managerial, financial and institutional mechanisms to support innovation [3].

Digital transformation opens up new opportunities for SMEs, but at the same time increases competition. Companies that use digital technologies only as an auxiliary tool run the risk of harming enterprises that are able to build full-fledged digital business models. Therefore, innovation activity management should be focused not only on the implementation of individual software solutions, but also on changing the logic of doing business.

The development of e-commerce is of particular importance. The growth in the volume of retail electronic commerce from 482.0 billion tenge in 2021 to 3,768.8 billion tenge in 2025 shows that digital sales channels are becoming the most important factor of competitiveness [2]. However, for the sustainable development of SMEs, it is necessary to ensure a balance between the use of marketplaces and the development of enterprises' own digital assets.

Conclusion. Managing the innovation activity of small and medium-sized businesses in the context of the digital transformation of the economy is the most important direction for increasing the competitiveness of Kazakhstan. The analysis showed that the SME sector plays a significant role in the national economy: as of January 1, 2025, 2,071.7 thousand SMEs operated in Kazakhstan, 4,422.1 thousand people were employed in the sector, and the output of products in 2024 amounted to 81,920.0 billion tenge [1]. At the same time, the level of innovative activity of enterprises remains limited and requires systematic support.

Digital transformation creates conditions for the growth of innovative activity of SMEs through e-commerce, digital platforms, automation of processes, data analytics and new financial technologies. However, to

realize this potential, an integrated approach is needed, including the development of digital infrastructure, increasing the competencies of entrepreneurs, affordable financing, institutional support and the formation of regional innovation ecosystems.

The practical significance of the research lies in the fact that the proposed model for managing SME innovation activity can be used in the development of programs to support entrepreneurship, digitalize business and increase the competitiveness of the regional economy.

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MARKETING WARS AND THE USE OF MILITARY STRATEGY IN SPORTS MARKETING

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MARKETING URUSHLARI VA SPORT MARKETINGIDA HARBIY STRATEGIYADAN FOYDALANISH

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МАРКЕТИНГОВЫЕ ВОЙНЫ И ИСПОЛЬЗОВАНИЕ ВОЕННОЙ СТРАТЕГИИ В СПОРТИВНОМ МАРКЕТИНГЕ

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Abstract

The article examines the specific features of marketing wars in sports due to high competition in the global market of sports goods and services. The main types of marketing strategies — defense, attack, flank and guerrilla — and the features of their application in the sports industry are analyzed. Examples of marketing confrontation between the world's leading sports brands, doping and information wars, as well as the influence of consumer psychology on the choice of sports products are given. The marketing struggle in sports is intellectual in nature and is largely determined by consumer perception of the brand. It is concluded that it is necessary for sports organizations to take into account the actions of competitors and create effective strategies in conditions of fierce competition.

Annotatsiya

Maqolada sport tovarlari va xizmatlarining global bozorida yuqori raqobat tufayli sportdagi marketing urushlarining o'ziga xos xususiyatlari ko'rib chiqiladi. Marketing strategiyalarining asosiy turlari — mudofaa, hujum, qanot va partizan — va ularni sport sanoatida qo'llash xususiyatlari tahlil qilinadi. Dunyoning yetakchi sport mahsulotlari brendlari, doping va axborot urushlari o'rtasidagi marketing qarama-qarshiligi, shuningdek, iste'molchilar psixologiyasining sport mahsulotlarini tanlashga ta'siri misollari keltirilgan. Sportdagi marketing kurashi intellektual xarakterga ega ekanligi va asosan iste'molchilarning brendni idrok etishi bilan belgilanadi. Sport tashkilotlari uchun raqobatchilarning harakatlarini hisobga olish va qattiq raqobat sharoitida samarali strategiyalarni yaratish zarurligi to'g'risida xulosa chiqarilmoqda.

Аннотация

В статье рассматриваются специфические особенности маркетинговых войн в спорте в условиях высокой конкуренции на мировом рынке спортивных товаров и услуг. Анализируются основные типы маркетинговых стратегий — оборонительные, наступательные, фланговые и партизанские — и особенности их применения в спортивной индустрии. Приводятся примеры маркетингового противостояния между ведущими мировыми спортивными брендами, допинговых и информационных войн, а также влияния психологии потребителя на выбор спортивной продукции. Маркетинговая борьба в спорте носит интеллектуальный характер и во многом определяется восприятием бренда потребителем. Делается вывод о необходимости для спортивных организаций учитывать действия конкурентов и создавать эффективные стратегии в условиях жесткой конкуренции.

Keywords: specific features of marketing warriors in sports, demand growth, defense strategy, attack strategy, free exercise, power strategy.

Kalit so'zlar: sportdagi marketing jangchilarining o'ziga xos xususiyatlari, talabning o'sishi, mudofaa strategiyasi, hujum strategiyasi, erkin mashq qilish, kuch strategiyasi.

Ключевые слова: специфика маркетинговых войн в спорте, рост спроса, оборонительная стратегия, наступательная стратегия, свободная практика, силовая стратегия.

Kirish.

Jahon sport industriyasining jadal sur’atlarda rivojlanib borishi sharoitida marketing sport sohasida raqobat ustunligini ta’minlovchi muhim omillardan biriga aylanmoqda. Hozirgi davrda sport faqat aholi salomatligini mustahkamlashga xizmat qiluvchi ijtimoiy soha sifatida emas, balki iqtisodiyotning sezilarli va dinamik tarkibiy qismi sifatida ham namoyon bo‘lmoqda. Mazkur makonda professional sportchilar, sport klublari, sport mahsulotlari ishlab chiqaruvchi brendlar hamda musobaqa tashkilotchilari tomoshabinlar e’tibori, homiylik mablag‘lari va moliyaviy imkoniyatlar uchun faol kurash olib bormoqda. Shu bois sportdagi raqobat an’anaviy bozor kurashidan chiqib, o‘ziga xos “marketing janglari” ko‘rinishini kasb etmoqda. Bunda klassik marketing yondashuvlari bilan bir qatorda harbiy strategiyalarga xos usullar, jumladan strategik rejalashtirish, raqib imkoniyatlarini tahlil qilish, hujumkor yoki himoyaviy taktikalardan foydalanish keng qo‘llanilmoqda.

So‘nggi o‘n yilliklarda globallashuv jarayonlarining kuchayishi, sport mahsulotlari va xizmatlariga bo‘lgan talabning ortishi, ommaviy axborot va media texnologiyalarining taraqqiyoti hamda professional sportning keng miqyosda rivojlanishi sport bozorida raqobatning yanada keskinlashishiga sabab bo‘ldi. Bu holat ayniqsa Nike va Adidas kabi xalqaro sport brendlari o‘rtasidagi raqobatda, shuningdek professional sportchilar va sport klublarining nufuz, tijorat shartnomalari hamda bozor yetakchiligi uchun olib borayotgan kurashida yaqqol namoyon bo‘ladi.

Ushbu maqola sport sanoatida yuzaga kelayotgan marketing urushlarining mohiyati, ularning strategik yondashuvlari, o‘ziga xos jihatlari hamda zamonaviy sport taraqqiyotiga ko‘rsatayotgan ta’sirini ilmiy jihatdan tahlil qilishga qaratilgan.

Tadqiqotning dolzarbligi

1. Mazkur tadqiqotda “sportdagi marketing urushlari” tushunchasi sport faoliyati, iqtisodiy raqobat va strategik boshqaruv tamoyillarini o‘zida mujassam etgan raqobat kurashining o‘ziga xos shakli sifatida talqin etiladi. Ushbu yondashuv sport bozoridagi zamonaviy raqobat jarayonlarini chuqurroq anglash imkonini beradi.

2. Sport sanoati faoliyatini tahlil qilish natijasida raqobat muhitiga ta’sir ko‘rsatuvchi qator muhim omillar aniqlangan. Jumladan, sport natijalarining noaniqligi, bozor sharoitlarining tez o‘zgaruvchanligi, sportchining marketing mahsuloti sifatida namoyon bo‘lishi hamda iste’molchilarning yuqori darajadagi emotsional jalb etilishi ushbu omillar qatoriga kiradi.

3. D. Trout va E. Ries tomonidan ilgari surilgan marketing urushlari strategiyalarini sport bozoriga tatbiq etish sport sohasining o‘ziga xos jihatlarini inobatga olgan holda asoslanadi. Xususan, sportning yuqori dinamik tabiati, axborot qarama-qarshiliklarining kuchayishi hamda imij va reputatsiyaning muhim o‘rin tutishi bu strategiyalarning ahamiyatini oshiradi. Shu bilan birga, D. Kaneman nazariyasiga ko‘ra, sport mahsulotlari bozorida iste’molchilarning qaror qabul qilish jarayoni faqat mantiqiy emas, balki intuitiv va psixologik omillar bilan ham chambarchas bog‘liqdir.

4. Tadqiqot doirasida sportdagi marketing qarama-qarshiliklarining asosiy misollari tizimli ravishda ko‘rib chiqilgan. Jumladan, Nike va Adidas brendlari o‘rtasidagi raqobat, Olimpiya o‘yinlaridagi partizan marketing strategiyalari, axborot kampaniyalari hamda doping bilan bog‘liq mojarolar sportni murakkab va ko‘p qatlamli raqobat maydoni sifatida talqin qilish imkonini beradi.

Tadqiqotning maqsadi

Mazkur tadqiqotning asosiy мақсади sport sohasidagi marketing urushlarining o‘ziga xos jihatlarini aniqlash, raqobat kurashida qo‘llaniladigan asosiy strategiyalarni tahlil qilish hamda ularni zamonaviy sport sanoati sharoitida qo‘llash mexanizmlarini ochib berishdan iborat.

Tadqiqot vazifalari

1. Zamonaviy sportni bozor munosabatlari va professional faoliyat sohasi sifatida tahlil qilish.

2. Marketing urushlari tushunchasining shakllanishi va uning sport sanoatidagi rolini o‘rganish.

3. Marketing strategiyalarining asosiy turlari — mudofaa, hujum, qanot va partizan strategiyalarini tahlil qilish hamda ularning sportdagi qo‘llanilish xususiyatlarini aniqlash.

4. Nike va Adidas kabi global sport brendlari o‘rtasidagi marketing raqobatini amaliy misollar asosida o‘rganish.

5. Iste’molchilar psixologiyasi va neyroiqtisodiy omillarning marketing strategiyalar samaradorligiga ta’sirini baholash.

6. Professional sportda axborot urushlari va doping mojarolarining raqobat muhitini shakllantirishdagi rolini tahlil qilish.

7. Sport tashkilotlari o‘rtasidagi marketing qarama-qarshiligida strategiya va resurs kuchining ahamiyati yuzasidan ilmiy xulosalar ishlab chiqish.

Tadqiqot obyekti

Sport sanoatidagi raqobat muhiti tadqiqot obyekti sifatida tanlangan.

Tadqiqot predmeti

Sport sohasidagi marketing urushlari strategiyalari, ularning mexanizmlari va amaliy qo‘llanish usullari tadqiqot predmeti hisoblanadi.

Tadqiqotning amaliy ahamiyati

Tadqiqot natijalari sport klublari, federatsiyalar, sport agentliklari hamda marketing mutaxassislari tomonidan global sport bozorida samarali raqobat strategiyalarini ishlab chiqishda amaliy qo‘llanishi mumkin. Taklif etilgan yondashuvlar iste’molchilar xulq-atvori, psixologik omillar va brend idroki xususiyatlarini hisobga olgan holda sport mahsulotlari, xizmatlari hamda sportchilarni ilgari surish bo‘yicha samaraliroq marketing strategiyalarini ishlab chiqishga xizmat qiladi. Tadqiqot materiallaridan jismoniy tarbiya va sport yo‘nalishidagi oliy ta’lim muassasalarida “Sport marketingi”, “Sport menejmenti” va “Sport sanoati” fanlarini o‘qitish jarayonida o‘quv-uslubiy manba sifatida foydalanish mumkin. Tadqiqotda shakllantirilgan nazariy xulosalar sport bozorida marketing tadqiqotlarini olib borish, raqobat muhitini baholash hamda reklama va kommunikatsiya kampaniyalarini rejalashtirishda qo‘l

keladi. Ishlab chiqilgan amaliy tavsiyalar sport tashkilotlariga axborot bosimlari, doping bilan bog‘liq inqirozli holatlar hamda reputatsion xavflarga nisbatan yanada samarali boshqaruv choralarini ishlab chiqish imkonini beradi.

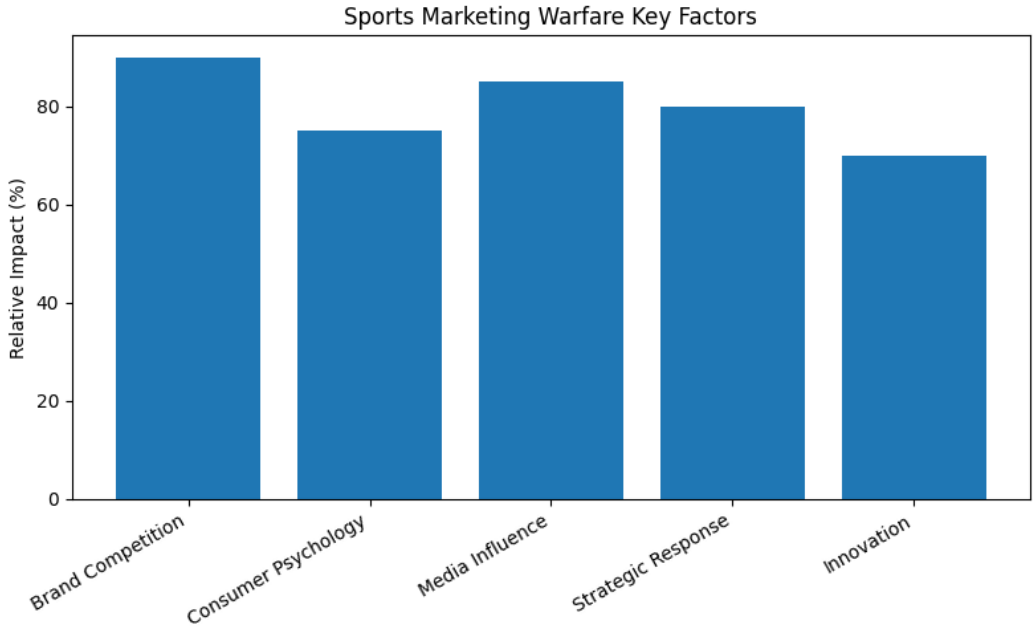
Adabiyotlar sharhi

Hozirgi davrda sog‘lom turmush tarziga intilish va barkamol shaxsni shakllantirish g‘oyasining ommalashuvi natijasida sport bilan shug‘ullanuvchilar soni sezilarli darajada ortib bormoqda. Shu bilan birga, aholining sport anjomlari, maxsus jihozlar, sport kiyimlari, poyabzallari hamda sohaga oid adabiyotlarga bo‘lgan ehtiyoji ham tobora kuchaymoqda. Biroq sport tadbirlarini tashkil etish, sport mahsulotlarini ishlab chiqarish va ularni bozorda ilgari surish jarayonlarida qanday iqtisodiy va marketing mexanizmlari faoliyat yuritayotgani oddiy iste’molchi, muxlis yoki sport ishqibozi uchun ko‘pincha noma’lum bo‘lib qolmoqda.

Sport kiyimlari va sport poyabzallari bugungi kunda eng talabgir mahsulotlar qatoriga kiradi hamda ayniqsa yoshlar orasida keng ommalashgan. Buning asosiy sababi ularning qulayligi, funksionalligi va kundalik hayotda ham erkin foydalanish imkoniyatidir.

Sport marketing urushlariga ta’sir etuvchi asosiy omillar

1-rasm.



Zamonaviy inson sport uslubidagi kiyimlarda nafaqat jismoniy mashg‘ulotlar davomida, balki dam olish, sayohat yoki kundalik turmushda ham o‘zini qulay his qiladi. Shu bois sport mahsulotlariga bo‘lgan talabning ortishi ushbu bozorda faoliyat yurituvchi kompaniyalar o‘rtasidagi raqobatni keskinlashtirmoqda.

Sport mahsulotlari ishlab chiqaruvchi kompaniyalar bozor ulushini kengaytirish, innovatsion mahsulotlarni taklif etish hamda iste’molchilar ishonchini qozonish uchun faol kurash olib bormoqda. Jahon miqyosida Nike va Adidas kabi yetakchi brendlar ushbu raqobatning eng yorqin namunasidir. Ushbu kompaniyalar doimiy ravishda mahsulot sifati, ishlab chiqarish texnologiyalari va marketing kommunikatsiyalarini takomillashtirish orqali global sport bozoridagi yetakchi mavqeini saqlab qolishga intiladi. Nike va Adidas o‘rtasidagi raqobat to‘g‘ridan-to‘g‘ri agressiv qarama-qarshilikdan ko‘ra ko‘proq strategik reklama kurashi ko‘rinishida namoyon bo‘ladi.

Ayniqsa futbol industriyasida ushbu brendlar o‘rtasidagi raqobat yaqqol ko‘zga tashlanadi. Har ikki kompaniya qimmat, kreativ va yuqori sifatli reklama kampaniyalari orqali o‘z auditoriyasiga ta’sir ko‘rsatishga harakat qiladi. Nike “Manchester United”, “Barcelona”, “Juventus”, “Inter”, “Valencia” kabi klublar bilan hamkorlik qilgan bo‘lsa, Adidas “Chelsea”, “Bayern Munich”, “Milan”, “Liverpool”, “Real Madrid” kabi klublar bilan uzoq muddatli shartnomalar tuzgan. Xuddi shuningdek, Ronaldinho, Cristiano Ronaldo, Federer, Nadal, Messi, Beckham kabi jahon sport yulduzlari orqali ham brendlar o‘zaro marketing kurashini olib borgan. Adidas ko‘proq fantastik va vizual jihatdan kuchli reklama konsepsiyalariga tayanadigan bo‘lsa, Nike individual ruhiyat, shaxsiy muvaffaqiyat va motivatsion yondashuvni afzal ko‘radi.

Marketing urushlari tushunchasi raqobatning kuchayishi natijasida shakllangan bo‘lib, bunda kompaniyalar faqat mijozlarga emas, balki raqobatchilarning strategik harakatlariga ham e’tibor qaratadi. Marketing nazariyasining asoschilaridan biri Filipp Kotler marketingni ehtiyoj va talablarni almashinuv orqali qondirishga qaratilgan inson faoliyati sifatida tavsiflaydi. Biroq marketing urushlari konsepsiyasi bu jarayonga boshqa nuqtai nazardan yondashib, biznes nafaqat iste’molchi ehtiyojlariga, balki raqobatchilar strategiyasiga ham moslashishi zarurligini ta’kidlaydi.

Sport marketingi zamonaviy iqtisodiyotning tez rivojlanayotgan yo‘nalishlaridan biri sifatida ko‘plab olimlarning ilmiy tadqiqot markazida bo‘lib kelmoqda. Sport sanoati bugungi kunda nafaqat jismoniy madaniyat va sog‘lom turmush tarzini rivojlantirish vositasi, balki milliardlab dollar aylanmaga ega global iqtisodiy

sektor sifatida shakllangan. Shu sababli sportdagi raqobat jarayonlarini marketing nuqtai nazaridan o‘rganish alohida ilmiy ahamiyat kasb etadi.

Marketing nazariyasining asoschilaridan biri Philip Kotler marketingni iste’molchilarning ehtiyoj va talablarini qondirishga qaratilgan almashinuv jarayoni sifatida ta’riflaydi. Biroq zamonaviy raqobat muhiti shuni ko‘rsatadiki, kompaniya muvaffaqiyati faqat iste’molchi ehtiyojlarini qondirish bilan emas, balki raqobatchilarning strategik harakatlariga munosib javob qaytarish bilan ham belgilanadi. Shu jihatdan Al Ries va Jack Trout tomonidan ishlab chiqilgan *Marketing Warfare* konsepsiyasi sport bozoridagi raqobatni tahlil qilish uchun muhim nazariy asos hisoblanadi.

Ushbu konsepsiyaga ko‘ra, marketing urushlari to‘rtta asosiy strategiyani o‘z ichiga oladi: mudofaa, hujum, qanot va partizan strategiyalari. Sport industriyasida bu yondashuv ayniqsa global sport brendlari — Nike va Adidas o‘rtasidagi ko‘p yillik raqobatda yaqqol namoyon bo‘ladi. Nike innovatsion mahsulotlar, mashhur sportchilar bilan individual reklama kampaniyalari va agressiv kommunikatsion strategiyalar orqali hujumkor modelni qo‘llasa, Adidas tarixiy brend kuchi, klublar bilan uzoq muddatli hamkorlik va imij marketingiga tayanadi.

Mullin, Hardy va Sutton sport marketingini sport mahsulotlari, xizmatlari va sport tashkilotlari bilan bog‘liq iste’molchilar xulq-atvorini boshqarish tizimi sifatida talqin qiladi. Ularning fikricha, sport marketingining boshqa sohalardan asosiy farqi iste’molchining yuqori emotsional jalb etilishidadir. Bu sport muxlislarining qaror qabul qilishida ratsional emas, hissiy omillar ustuvor bo‘lishini ko‘rsatadi.

Mazkur fikr Daniel Kahneman tomonidan ishlab chiqilgan ikki tizimli qaror qabul qilish nazariyasi bilan ham mos keladi. Olimning ta’kidlashicha, iste’molchilar qaror qabul qilishda tezkor intuitiv fikrlash (System 1) va mantiqiy tahliliy fikrlash (System 2) mexanizmlaridan foydalanadi. Sport mahsulotlari bozorida ayniqsa brendga sodiqlik, mashhur sportchilar ta’siri, reklama kampaniyalari va ijtimoiy trendlar intuitiv qarorlarni kuchaytiradi.

Marketing urushlari strategiyalarining sport sohasida qo‘llanilishi

1 jadval.

Strategiya turi	**Tavsifi**	**Sportdagi misol**	**Qo‘llash maqsadi**
Mudofaa	Bozor yetakchisi mavqeini saqlash	Adidasning Yevropa bozoridagi pozitsiyasi	Mavjud ulushni himoya qilish
Hujum	Raqib zaif tomonlariga zarba berish	Nike innovatsion kampaniyalari	Bozor ulushini oshirish
Qanot	Bo‘sh segmentlarga kirish	Yangi fitness wear segmentlari	Yangi auditoriyani jalb qilish
Partizan	Cheklangan resurs bilan nishonga yo‘naltirilgan kurash	Mahalliy sport brendlari	Tor segmentda ustunlik

Sport marketing bo‘yicha zamonaviy tadqiqotlar shuni ko‘rsatadiki, sport mahsulotlarini tanlashda nafaqat mahsulot sifati, balki brend imiji, sport yulduzlari bilan assotsiatsiya va kommunikatsion strategiyalar muhim rol o‘ynaydi. Bu esa sport marketingini oddiy savdo faoliyatidan ko‘ra murakkab strategik boshqaruv tizimiga aylantiradi.

Bundan tashqari, sport marketingida axborot urushlari, reputatsion boshqaruv, doping bilan bog‘liq inqirozli vaziyatlar va partizan marketing kabi yangi tendensiyalar ham paydo bo‘lmoqda. Olimpiya o‘yinlari, FIFA Jahon chempionati kabi yirik sport tadbirlarida rasmiy homiy bo‘lmagan kompaniyalarning auditoriya e’tiborini jalb qilishga qaratilgan *ambush marketing* (partizan marketing) strategiyalari bu yo‘nalishning amaliy ko‘rinishidir.

Tadqiqot natijasida aniqlanishicha, sport marketingidagi raqobat an’anaviy biznes raqobatidan ko‘ra murakkabroq bo‘lib, bunda iqtisodiy, psixologik, kommunikatsion va strategik omillar bir vaqtning o‘zida ta’sir ko‘rsatadi. Shu bois ushbu tadqiqot sportdagi marketing urushlarini kompleks tizim sifatida ko‘rib chiqadi. **1-Rasm** da sport marketing urushlariga ta’sir etuvchi asosiy omillar (brend raqobati, iste’molchilar psixologiyasi, media ta’siri, strategik qarorlar va innovatsiyalar) vizual tarzda ifodalangan. 1-jadvalda esa marketing urushlari strategiyalarining sport sanoatidagi amaliy qo‘llanilish shakllari tizimlashtirilgan.

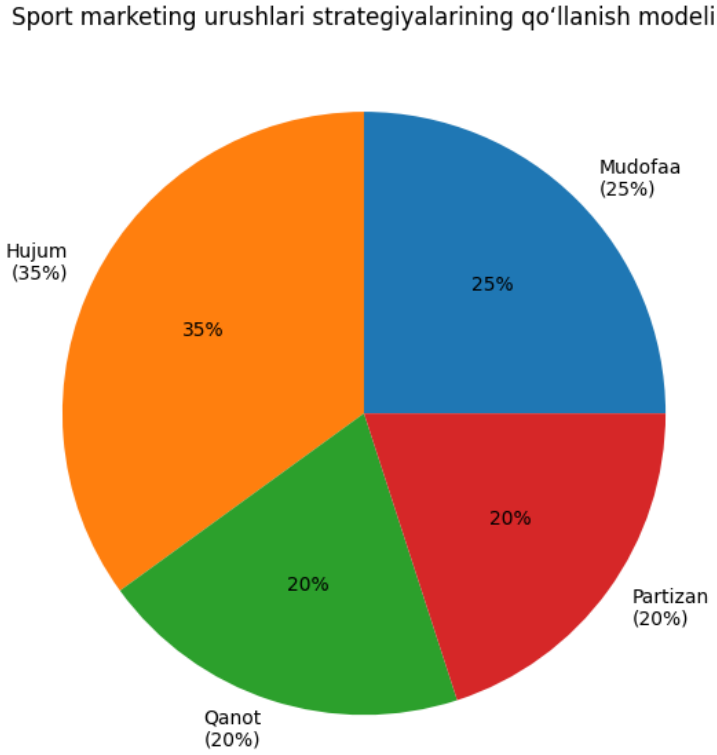
Zamonaviy biznes muhitida muvaffaqiyatga erishish uchun kompaniya faqat o‘z mahsulotiga emas, balki raqiblarning zaif tomonlarini aniqlash va ularga mos marketing strategiyalarini ishlab chiqishga ham e’tibor qaratishi lozim. Bozor sharoitlari o‘zgaruvchan va dinamik bo‘lgani sababli strategik rejalashtirishda nafaqat iste’molchilar talabi, balki raqobatchilarning ehtimoliy harakatlari ham hisobga olinishi zarur.

D. Trout va E. Ries o‘zlarining *“Marketing Warfare”* asarida marketing raqobatining to‘rtta asosiy strategik modelini ajratib ko‘rsatadi: mudofaa, hujum, qanot va partizan strategiyalari. Ushbu strategiyalar kompaniyaning bozordagi mavqei, resurs imkoniyatlari hamda raqobat muhitiga qarab tanlanadi. Mudofaa strategiyasi asosan bozor yetakchilari tomonidan qo‘llanilib, mavjud pozitsiyani mustahkamlash va raqobatchilar bosimiga qarshi turishga xizmat qiladi. Hujum strategiyasi esa raqiblarning zaif tomonlarini aniqlash, innovatsion mahsulotlar va agressiv marketing kampaniyalari orqali bozor ulushini kengaytirishga qaratiladi. Qanot strategiyasi to‘g‘ridan-to‘g‘ri raqobatga kirishmasdan, bozorning to‘liq egallanmagan segmentlarini o‘zlashtirishni nazarda tutadi. Partizan strategiyasi esa resurslari cheklangan kichik kompaniyalar uchun mos bo‘lib, tor bozor segmentlarida tezkor va moslashuvchan raqobat yuritish imkonini beradi.

1-rasmda sport marketing urushlarida ushbu strategiyalarning shartli qo‘llanish taqsimoti ko‘rsatilgan.

2-rasm. Sport marketing urushlari strategiyalarining qo‘llanish modeli

Tahliliy yondashuv asosida diagrammadan ko‘rish mumkinki, hujum strategiyasi (35%) sport marketingida eng faol qo‘llaniladigan model hisoblanadi, chunki global sport bozorida innovatsiyalar, agressiv reklama kampaniyalari va bozor ulushini kengaytirish uchun faol kurash muhim ahamiyatga ega. Mudofaa strategiyasi (25%) esa bozorda yetakchi mavqega ega kompaniyalar tomonidan mavjud ustunlikni saqlash vositasi sifatida qo‘llaniladi. Qanot (20%) va partizan strategiyalari (20%) esa nisbatan kichikroq kompaniyalar yoki bozorning yangi segmentlariga kirishni maqsad qilgan tashkilotlar uchun samarali hisoblanadi.



2-rasm.

Nike va Adidas o‘rtasidagi global raqobat ushbu strategiyalarning amaliy ifodasi sifatida qaralishi mumkin. Adidas esa Germaniya va Yevropa bozoridagi tarixiy ustunligi, brend sodiqligi va institutsional hamkorliklari orqali mudofaa strategiyasiga tayangan. Ichki bozor imkoniyatlari toraygani sari har ikki kompaniya global sport bozorida to‘qnash kelib, marketing urushlarining klassik modelini shakllantirdi. Bu holat sport marketingida strategik raqobatning qanchalik muhim ekanligini yaqqol ko‘rsatadi.

Marketing urushlarida sifat muhim omil bo‘lsa-da, ko‘pincha resurs ustunligi yanada katta ahamiyat kasb etadi. Yirik kompaniyalar reklama kampaniyalari, ilmiy tadqiqotlar, distribyutorlik tarmoqlari va innovatsion ishlanmalar uchun ko‘proq mablag‘ sarflash imkoniyatiga ega. Shu sababli kichik kompaniyalar to‘g‘ridan-to‘g‘ri raqobat o‘rniga moslashuvchan strategiyalarni qo‘llashi lozim. Harbiy strategiya tamoyillarining marketingga qo‘llanishi aynan mana shu nuqtada namoyon bo‘ladi, chunki muvaffaqiyat faqat mahsulot sifatiga emas, balki to‘g‘ri strategik qarorlar va resurslarni samarali taqsimlashga ham bog‘liqdir.

Shunday qilib, sport marketingidagi raqobat oddiy tijorat kurashidan ko‘ra murakkabroq bo‘lib, unda iqtisodiy manfaatlar, psixologik ta’sir, axborot boshqaruvi va strategik rejalashtirish muhim rol o‘ynaydi.

Tadqiqotning metodologik asoslari quyidagilardan iborat:

Mazkur tadqiqotning nazariy-metodologik asosini marketingning klassik va zamonaviy konsepsiyalari, strategik boshqaruv nazariyalari, xulq-atvor iqtisodiyoti hamda sport iqtisodiyoti bo‘yicha ilmiy yondashuvlar tashkil etadi. Xususan, Philip Kotler tomonidan ishlab chiqilgan marketing nazariyasi, unda marketing inson ehtiyojlari va talablarini almashinuv jarayoni orqali qondirishga qaratilgan faoliyat sifatida talqin qilinadi, tadqiqotning konseptual poydevori sifatida xizmat qildi . Shu bilan birga, sport bozoridagi raqobatni chuqur tahlil qilish maqsadida Al Ries va Jack Trout tomonidan ilgari surilgan “Marketing Warfare” konsepsiyasi asosiy nazariy model sifatida qo‘llanildi. Mazkur yondashuv marketing faoliyatini raqobat kurashi sifatida ko‘rib, kompaniyalarning bozordagi harakatlarini strategik qarama-qarshilik nuqtai nazaridan baholash imkonini beradi.

Tadqiqotda sport marketingidagi raqobat jarayonlarini tushuntirish uchun harbiy strategiya tamoyillaridan ham metodologik vosita sifatida foydalanildi. Jumladan, kuchlar nisbatini baholash, raqibning zaif tomonlarini aniqlash, strategik hujum

yo‘nalishlarini tanlash, razvedka va bozor tahlili kabi elementlar marketing urushlarining tarkibiy qismi sifatida ko‘rib chiqildi. Ushbu yondashuv sport marketingida bozor raqobati ko‘pincha an’anaviy savdo kurashidan ko‘ra murakkabroq strategik jarayon ekanligini ko‘rsatadi.

Sport sanoati mazkur tadqiqotda faqat iqtisodiy faoliyat sohasi sifatida emas, balki ijtimoiy, psixologik va kommunikatsion jihatlarni o‘zida mujassam etgan kompleks tizim sifatida tahlil qilindi. Professional sportning tijoratlashuvi natijasida sportchilar nafaqat sport subyekti, balki marketing qiymatiga ega bo‘lgan “brend mahsulot” sifatida ham qaralmoqda . Bu holat sport marketingini an’anaviy mahsulot marketingidan sezilarli darajada farqlaydi.

Tadqiqotda iste’molchilar xulq-atvorini tushuntirish uchun neyroiqtisodiyot va xulq-atvor iqtisodiyoti yondashuvlari ham qo‘llanildi. Xususan, Daniel Kahnemanning inson qaror qabul qilish jarayoniga oid ikki tizimli fikrlash modeli sport mahsulotlari va sport brendlariga nisbatan iste’molchilar tanlovini izohlashda muhim nazariy asos bo‘lib xizmat qildi . Ushbu nazariyaga ko‘ra, iste’molchilar ko‘pincha mahsulot tanlashda mantiqiy tahlildan ko‘ra intuitiv va emotsional qarorlarga tayanadi. Ayniqsa sport marketingida mashhur sportchilar, brend identifikatsiyasi, reklama kampaniyalari va hissiy bog‘liqlik xarid qarorlariga sezilarli ta’sir ko‘rsatadi.

Mazkur tadqiqotda qiyosiy tahlil usuli orqali global sport bozoridagi asosiy raqobatchilar — Nike va Adidas kompaniyalari marketing strategiyalari, reklama yondashuvlari va bozor pozitsiyalari o‘zaro taqqoslandi. Kontent tahlili yordamida sport reklamalari, homiylik kampaniyalari va kommunikatsion strategiyalar mazmun jihatdan o‘rganildi. Keys-stadi yondashuvi asosida Nike va Adidas o‘rtasidagi marketing urushi, Olimpiya o‘yinlaridagi partizan marketing holatlari hamda doping bilan bog‘liq reputatsion mojarolar amaliy misollar sifatida ko‘rib chiqildi.

Bundan tashqari, tizimli yondashuv asosida sport marketingi iqtisodiy, strategik, kommunikatsion va psixologik elementlarning o‘zaro bog‘langan murakkab mexanizmi sifatida talqin qilindi. Tadqiqot natijalarini yanada aniqroq ifodalash maqsadida vizual analitik usullardan ham foydalanilib, diagrammalar, jadvallar va strategik taqsimot modellaridan foydalanildi.

Shunday qilib, tanlangan nazariy-metodologik yondashuv sport marketingidagi raqobatni ko‘p qirrali ilmiy nuqtai nazardan tahlil qilish, marketing urushlari mexanizmlarini ochib berish hamda sport sanoatida qo‘llanilayotgan strategik modellarni ilmiy asosda baholash imkonini berdi.

Mazkur tadqiqot natijalari shuni ko‘rsatdiki, jismoniy tarbiya va sport nomoddiy ishlab chiqarishning muhim tarkibiy qismlaridan biri hisoblanib, boshqa iqtisodiy faoliyat turlaridan o‘zining o‘ziga xos xususiyatlari bilan farqlanadi. Xususan, sport sohasida natijalarning oldindan aniq prognoz qilinmasligi, yuqori darajadagi dinamiklik, xizmatlarning saqlanmasligi hamda emotsional iste’mol omilining kuchliligi uni alohida iqtisodiy kategoriya sifatida shakllantiradi. Shu bilan birga, sportchining asosiy maqsadi nufuzli musobaqalarda yuqori natijalarga erishish va sport muvaffaqiyatini qo‘lga kiritish bo‘lsa, sport industriyasida faoliyat yurituvchi tadbirkorlik subyektlari maksimal iqtisodiy foyda olishga intiladi. Bu esa sport bozorida sport natijalari va iqtisodiy manfaatlar o‘rtasidagi uzviy bog‘liqlikni yuzaga keltiradi.

Tahlillar shuni ko‘rsatadiki, sport sanoatida vaqt omili alohida ahamiyat kasb etadi. Agar an’anaviy ishlab chiqarish tarmoqlarida foydaning kichik ulushdagi o‘zgarishi sezilarli strategik xavf tug‘dirmasa, professional sportda soniyaning ulushi ham Olimpiya o‘yinlari, jahon chempionatlari yoki boshqa nufuzli musobaqalarda g‘oliblik taqdirini hal qilishi mumkin. Mazkur holat sport bozoridagi raqobatning o‘ta keskin va yuqori xavfli ekanligini ko‘rsatadi.

Bozor iqtisodiyoti sharoitida professional sport tobora tijoratlashib borayotganligi natijasida sportchi marketing qiymatiga ega bo‘lgan iqtisodiy subyektga aylangan. Uning sport xizmatlari menejerlar, agentlar va marketing vositalari orqali raqobatbardosh bozorga taklif etiladi. Shu sababli sport tovarlari va xizmatlari bozorida klassik marketing tamoyillari bilan bir qatorda marketing urushlari konsepsiyasi ham faol qo‘llanilmoqda.

Tadqiqot davomida aniqlanishicha, professional sportdagi kuchli raqobat sharoitida muvaffaqiyatga erishish uchun sport klublari, federatsiyalar va sport kompaniyalari nafaqat iste’molchilar ehtiyojlariga, balki raqobatchilar strategiyasiga ham e’tibor qaratishlari zarur. Raqobatchilarning harakatlari, bozor pozitsiyasi, innovatsion yondashuvlari va kommunikatsion faoliyatini muntazam monitoring qilish samarali strategik boshqaruvning muhim elementi hisoblanadi.

Shuningdek, sport marketingida kuch va strategik ustunlik tamoyili alohida ahamiyat kasb etishi aniqlandi. Marketing urushlarida mahsulot sifati muhim omil bo‘lsa-da, resurslar ustunligi, kommunikatsion salohiyat va strategik rejalashtirish ko‘pincha hal qiluvchi rol o‘ynaydi. Yirik kompaniyalarning reklama, innovatsiyalar va homiylik loyihalariga katta sarmoya kiritish imkoniyati ularga bozorda sezilarli ustunlik beradi. Shu sababli marketing faoliyatida muvaffaqiyat ko‘pincha eng yaxshi mahsulot emas, balki eng samarali strategik yondashuv bilan belgilanadi.

Tadqiqot natijalari shuni ham ko‘rsatadiki, marketing urushlari konsepsiyasida g‘alaba qozonish faqat hujumkor strategiyalarni qo‘llash bilan emas, balki xavflarni boshqarish va mag‘lubiyatlarning oldini olish ko‘nikmalarini shakllantirish bilan ham bog‘liqdir. Strategik boshqaruvda asosiy maqsad faqat bozorda yetakchilikka erishish emas, balki mavjud pozitsiyani saqlab qolish va raqobat xatarlariga moslashuvchan javob qaytarishdan iborat.

Xulosa va takliflar.

Shu asosda quyidagi amaliy takliflarni ilgari surish mumkin: sport tashkilotlarida marketing razvedkasi va raqobatchilar monitoringi tizimini rivojlantirish, iste’molchilar psixologiyasiga asoslangan brending strategiyalarini kuchaytirish, sport

mahsulotlari va xizmatlarida innovatsion marketing yondashuvlarini keng qo‘llash, axborot hujumlari va reputatsion xavflarga qarshi inqirozli kommunikatsiya strategiyalarini ishlab chiqish hamda sport marketingi mutaxassislarini strategik boshqaruv kompetensiyalari asosida tayyorlash maqsadga muvofiqdir.

Xulosa qilib aytganda, zamonaviy sport marketingi oddiy savdo faoliyatidan ancha kengroq tushuncha bo‘lib, u iqtisodiy manfaatlar, strategik raqobat, iste’molchilar xulq-atvori va kommunikatsion boshqaruvning murakkab integratsiyasini ifodalaydi. Shu bois sport sohasida muvaffaqiyatga erishish nafaqat sport natijalari, balki to‘g‘ri tanlangan marketing strategiyasi bilan ham bevosita bog‘liqdir.

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JURISPRUDENCE

CENTRAL BANKS DIGITAL CURRENCIES IMPACT ON FINANCIAL STABILITY: A GEORGIAN PERSPECTIVE

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Abstract

This paper examines the impact of central bank digital currencies (CBDCs) on financial stability at the global level and in Georgia, through the prism of legal regulation and institutional mechanisms. In the context of the digitalization of financial markets and the transformation of payment infrastructure, the introduction of CBDCs requires a renewed legal analysis of monetary circulation related legal categories, central bank mandates and financial stability mechanisms.

The paper explores the concept and legal nature of central bank digital currencies, with particular attention given to legal risks such as the role of commercial banks, the protection of financial market participants' rights, confidentiality and cybersecurity.

The study analyzes international experience in the introduction and legal regulation of CBDCs and assesses the approach of the National Bank of Georgia to the potential implementation of a digital currency. In conclusion, the paper recommends the formation of a comprehensive legal framework that balances innovation and the protection of financial stability in the process of CBDC implementation.

Keywords: Central bank digital currencies (CBDC), financial stability, legal regulation, central bank, National Bank of Georgia, digitalization of monetary circulation, Georgia.

Introduction

Advances in technology and the digitalization of financial markets have fundamentally affected traditional mechanisms of monetary circulation and financial regulation. A key expression of this transformation is the development of central bank digital currencies, the potential issuance of which has generated growing debate. In contrast to private crypto-assets and electronic money, CBDCs are a digital manifestation of national currency issued by central banks and granted legal tender status, giving them a unique legal position within the monetary system (Bank for International Settlements [BIS], 2020).

The introduction of CBDCs by central banks raises several fundamental legal issues related to the legal nature of money, central bank mandates and mechanisms for ensuring financial stability. Traditionally, financial stability has been a core objective of monetary and supervisory policy; however, in the context of digitalization, it increasingly becomes an object of legal regulation. In this regard, CBDCs appear not only as technological innovations but also as independent legal institutions that require the formation of a normative framework to ensure the resilience of the financial system (International Monetary Fund [IMF], 2025).

From a legal perspective, the implementation of CBDCs encompasses a wide range of issues, including the definition of powers between central banks and other financial authorities, as well as the legal status of user rights protection. Importance is attached to financial confidentiality, data processing and cybersecurity, as the digital form of national currency implies complex technological solutions. In addition, CBDCs may affect the traditional banking system, which necessitates legal assessment and analysis of potential consequences to maintain the stability of the banking sector (International Monetary Fund [IMF], 2020).

International experience demonstrates that central banks adopt different legal and regulatory approaches at various stages of CBDC development and testing. International financial institutions emphasize the need for gradual and cautious implementation of CBDCs, considering potential legal risks and institutional implications. At present, there is no unified legal model for CBDC regulation, which underscores the importance of national context and comparative legal analysis (Bank for International Settlements [BIS], 2021).

Georgia presents scholarly interest in this area, as its financial system is characterized by institutional stability and the active introduction of digital financial services. Nevertheless, the potential issuance of a digital currency by the National Bank of Georgia requires a comprehensive analysis. It is necessary to assess the compatibility of CBDC implementation with existing financial and banking legislation, the mandate of the National Bank and mechanisms for ensuring financial stability. These considerations give special legal significance to the present research (International Monetary Fund [IMF], 2025).

The objective of this paper is to examine the implications of central bank digital currencies for financial stability from a legal regulatory perspective, with reference to Georgia. The study analyzes the legal nature of CBDCs, key regulatory models and potential legal risks to financial stability. The findings aim to inform national legal policy and contribute to the improvement of legislation in the context of digital

currencies and the ongoing digitalization of the financial system (Bank for International Settlements [BIS], 2021).

Research Methodology

The study primarily employs the formal legal analysis method to examine the legal nature of central bank digital currencies, their compatibility with traditional forms of money and their place within the financial law system. In addition, the comparative legal method is used to analyze different approaches to CBDC regulation in international practice, while the systemic legal analysis method is applied to assess the impact of CBDCs on financial stability.

The Legal Nature and Essence of Central Bank Digital Currencies (CBDCs)

Central bank digital currencies represent a digital form of national currency issued by central banks. From a legal perspective, CBDCs differ from other crypto-assets and electronic money in that they are based on state monetary sovereignty and the authority to issue money and are integrated into the monetary circulation system. International financial organizations emphasize that CBDCs should be regarded as legal tender, or at a minimum as an equivalent of central bank cash and non-cash money, which determines their special legal status within the financial law system (Bank for International Settlements [BIS], 2020).

A key legal issue concerns the classification of CBDCs as a financial and monetary object. They may be viewed either as a new form of central bank money or as a digital payment instrument with specific legal characteristics. International legal doctrine indicates that, regardless of technological design, CBDCs retain the characteristics of public money and are backed by state guarantees ensuring their integration into the monetary and credit system. This distinguishes CBDCs from electronic money issued by private entities and underscores their connection to financial law and public money (International Monetary Fund [IMF], 2020).

An important element of the legal nature of CBDCs is their relationship with national currency. International organizations note that the introduction of CBDCs does not imply the automatic abolition of cash, rather, CBDCs are considered a complement. From a legal standpoint, this requires defining the status of CBDCs within the hierarchy of payment instruments, as well as regulating their circulation, storage and use. Normative regulation in this area is closely linked to the objective of ensuring financial stability (European Central Bank [ECB], 2020).

The essence of CBDCs is closely related to central bank mandates and the limits of their authority. The introduction of CBDCs may necessitate a review or clarification of regulatory norms defining central bank objectives and functions, while safeguarding the core purpose of financial stability. International studies emphasize that the implementation of CBDCs without proper legal regulation may create legal risks related to the overextension of central bank powers and ambiguity regarding institutional responsibility (International Monetary Fund [IMF], 2020).

Attention should be given to the legal classification of CBDCs within the framework of financial legislation. Depending on the design of the digital currency (token-based or account-based), legal regimes governing ownership and transfer may differ. International practice highlights the need to adapt regulations related to payment services, data protection and anti-money laundering to the specific characteristics of CBDCs. Consequently, the legal nature of CBDCs extends beyond the traditional framework of monetary law and intersects with financial and digital regulation (International Monetary Fund [IMF], 2025).

In summary, the legal nature of CBDCs is defined by the coexistence of traditional public money and new legal elements arising from digitalization. Comparative international experience underscores that successful CBDC implementation depends on a robust legal framework that ensures legal certainty, protects users' rights and upholds financial stability (Bank for International Settlements [BIS], 2021).

Positive Aspects and Risks of CBDC Implementation

One of the main advantages of CBDC implementation is increased efficiency of payment systems and the strengthened role of central banks in ensuring stable and secure monetary circulation. International organizations note that CBDCs facilitate faster transactions, more convenient settlements and expanded access to financial services. These benefits are significant not only economically but also legally, particularly in terms of equal access, payment infrastructure development and the protection of public interests (Bank for International Settlements [BIS], 2020).

Another positive aspect is increased transparency of monetary circulation and enhanced legal oversight mechanisms. The digital form of national currency enables central banks to exercise more effective control over money laundering and terrorism financing. At the same time, international organizations emphasize the need to maintain a balance between public interests, user rights, and financial confidentiality (European Central Bank [ECB], 2020).

Despite these advantages, CBDC implementation entails several potential risks. One of the most significant risks concerns the impact on commercial banks and intermediary financial institutions. International studies indicate that, in the absence of adequate legal limitations, CBDCs may lead to the transfer of deposits from commercial banks to central banks, posing risks to financial stability and underscoring the importance of regulatory intervention (International Monetary Fund [IMF], 2020).

CBDCs may also involve legal and technological risks related to cybersecurity, personal data protection and the operational resilience of payment systems. The digital form of national currency relies on complex technological infrastructure and any disruption may result in systemic legal consequences. Therefore, the establishment of a comprehensive legal framework is essential to manage risks and protect user rights (International Monetary Fund [IMF], 2023).

In conclusion, the benefits and risks of CBDC implementation are closely connected to their legal and institutional configuration. The realization of CBDC advantages depends on a clear and coherent regulatory

framework, without which risks to financial stability and users' financial relationships may increase.

International Experience in CBDC Implementation and Legal Regulation

1. General Legal Approaches to CBDCs

International financial organizations consider CBDCs as a potential element of future monetary systems, emphasizing financial stability, efficiency and the protection of national currencies. The Bank for International Settlements highlights key CBDC characteristics, including legal status as a central bank liability, legal clarity and compatibility with existing financial infrastructure. Special attention is paid to the legal and institutional frameworks accompanying CBDC implementation (Bank for International Settlements [BIS], 2020).

2. European Approach: The Digital Euro

The European Central Bank views the digital euro as a complement to cash rather than a replacement, emphasizing financial stability and the role of the banking sector. Official ECB documents stress that the introduction of a digital euro requires a solid legal foundation, clear legal status and mechanisms for protecting users' personal data, as well as ensuring confidentiality, anti-money laundering compliance and clear allocation of responsibilities among payment system participants (European Central Bank [ECB], 2020).

3. International Monetary Fund Approach

The International Monetary Fund places particular emphasis on legal aspects related to CBDC implementation within the framework of monetary and banking law. The International Monetary Fund analytical documents indicate that CBDC introduction may require amendments to laws governing central banks, payment systems, and data protection. It also highlights the importance of assessing legal risks, particularly regarding deposits and the role of commercial banks, to preserve financial stability (International Monetary Fund [IMF], 2020).

CBDC impact largely depends on their conceptual and institutional characteristics, which determine their role in the financial system and the scope of legal regulation. Gradual implementation, limitations on holdings and usage, and clear legal delineation of central and commercial bank functions can mitigate potential risks. Overall, international analysis confirms the necessity of a comprehensive legal approach to CBDC implementation (Bank for International Settlements [BIS], 2021).

CBDC Pilot Programs Worldwide

Several countries have launched or piloted CBDCs, enabling assessment of not only technological aspects but also their impact on financial systems and users. One of the first full-scale pilot projects was the **Send Dollar** in the Bahamas, launched in October 2020. Despite technological readiness, limited infrastructure and weak integration with commercial banks have resulted in low user adoption, hindering transition from pilot to widespread use (Central Bank of The Bahamas, 2020).

Another significant example of CBDC implementation is the **eNaira**, the digital currency of the Central Bank of Nigeria. It has been an official means of payment since October 2021. Despite an active marketing campaign, its usage remains low, a portion of users express dissatisfaction due to technical disruptions and difficulties related to identification, as well as a low level of trust in the currency. These factors significantly limit its practical application (Central Bank of Nigeria, 2021).

An important case is Jamaica's **Jam-Dex**, launched in July 2022, aimed at increasing payment speed and financial inclusion. While user acceptance has been relatively high, its effectiveness depends largely on integration with existing payment systems and public awareness (Bank of Jamaica, 2022).

One of the largest global pilot programs is **Project mBridge**, involving the central banks of China, Thailand and Hong Kong. The project tested cross-border transactions using CBDCs, enabling real-time settlements worth millions of dollars. While demonstrating CBDCs' potential for international payments and liquidity management, the platform has not yet been adopted as permanent infrastructure (Bank for International Settlements [BIS], 2022).

Another notable example is Russia's **digital ruble** project. In 2025, the Central Bank of Russia expanded its pilot program to include 9,000 users and 1,200 companies, aiming for mass adoption between 2026 and 2028. By July 2025, approximately 2,500 digital wallets had been opened and transaction volumes approached 100,000. The government also used the digital ruble for budgetary payments, demonstrating practical progress (Human Rights Foundation CBDC Tracker, 2025).

Additionally, various countries are implementing sector-specific pilot programs. In China (**e-CNY**), India and Australia, CBDCs are being tested with millions of users under different economic scenarios and in partnership with fintech companies. These tests allow central banks to evaluate CBDC performance in real conditions and identify technical, legal and social barriers prior to full-scale implementation (Atlantic Council, 2025).

The Georgian Perspective on CBDC Implementation

Since 2020, the National Bank of Georgia (NBG) has actively explored the possibility of introducing a digital currency the Digital Lari (**Digital GEL**). The initiative aims to enhance payment system capabilities and promote innovative financial technologies within the Georgian economy. To develop the CBDC concept, the NBG engaged technological and fintech partners and stated that the digital GEL would have legal tender status (National Bank of Georgia, 2021).

In 2023, the NBG officially announced the launch of a pilot project for the digital GEL and initiated a tender to select technological partners. Several international companies with experience in CBDC development were selected to test the practical application of the digital GEL (National Bank of Georgia, 2023).

As a result of the competition, international technology companies were selected, including well-known providers of CBDC infrastructure. This underscores the approach of the National Bank of Georgia, which is focused on involving entities with both international and domestic experience in the process of developing and implementing a CBDC. The **Digital GEL** project is

aimed at the development of technologies that will enable individual and corporate payments, thereby supporting the integration of a CBDC into Georgia's real financial economy (Digital Pound Foundation, 2023).

The pilot program is referenced in national strategic documents on financial innovation and is designed to test technologies under limited access conditions, assess platform functionality, and identify potential legal and technical risks. This approach aligns with international best practices, where central banks conduct limited pilots before deciding on full-scale implementation (National Bank of Georgia, 2025).

Accordingly, the NBG has not rushed to make a final decision on issuing the digital GEL, emphasizing the importance of technical, legal and institutional considerations. NBG representatives note that following completion of technological testing, discussions will focus on the necessity and scope of CBDC implementation, considering risks and opportunities (Spress.ge, 2024).

International data confirm that the digital GEL project remains in the pilot stage, reflecting the NBG's consistent approach to CBDC development in line with international standards and national financial system characteristics. This strategy supports risk minimization and informed decision-making (Human Rights Foundation CBDC Tracker, 2025).

Conclusion

The analysis demonstrates that central bank digital currencies represent not only technological innovations but also a new form of public money whose implementation requires comprehensive legal consideration. International experience shows that successful CBDC implementation depends on their conceptual and institutional design, understanding of their legal nature and institutional balance between central banks, commercial banks and users. In this context, CBDCs appear as a public law instrument closely linked to central bank mandates and financial stability objectives.

The analysis of pilot programs indicates that even with technological readiness, countries face institutional risks and limited user acceptance, underscoring the need for gradual implementation.

Georgia's approach to CBDC development is characterized by caution and phased testing, focused on evaluating legal implications in advance.

Overall, the study concludes that CBDC implementation requires not only technological and economic assessment but, above all, the creation of a solid legal foundation encompassing legal status, user protection mechanisms and institutional competence within the financial system.

For the future development of the digital GEL project in Georgia, it is advisable to consider a strategy for the consistent formation of a legal framework, based on the results of pilot implementation, international regulatory standards, and the practical experience of other states.

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MEDICAL SCIENCES

PANIC ATTACKS IN UNIVERSITY STUDENTS: CAUSES AND EFFECTS

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Abstract

Panic attacks are sudden episodes of intense fear and physiological distress that significantly disrupt emotional regulation, cognitive processing, and academic performance. University students are particularly vulnerable due to the cumulative pressures of academic demands, social transitions, and personal development. This study explores the prevalence, risk factors, and coping strategies associated with panic attacks among university students, based on a cross-sectional survey of 150 participants aged 18–25. Results indicate that 63.3% of respondents have experienced panic attacks, with symptoms such as numbness in extremities (25.3%), fear of death or loss of control (30%), palpitations, and shortness of breath being most common. Despite the high prevalence, 84% of students reported not receiving any psychological or medical support, highlighting a critical gap in mental health services.

Key risk factors identified include academic stress (27.3%), poor sleep hygiene, prolonged screen exposure (44.7%), low physical activity, and family history of panic disorders. These findings align with global literature, which emphasizes the role of neurobiological, psychological, and lifestyle determinants in panic disorder onset. Guan and Cao (2023) underscore the involvement of the amygdala and hypothalamus in panic responses, while Hofmann et al. (2012) demonstrate the efficacy of cognitive behavioral therapy (CBT) in treating panic-related symptoms.

Coping strategies employed by students include physical activity (32.7%), breathing exercises, meditation, and music therapy, though only 38% found these methods highly effective. The study emphasizes the urgent need for institutional mental health support, awareness campaigns, and structured interventions such as CBT and mindfulness training. By integrating local data with international research, this paper contributes to a broader understanding of panic attacks in academic settings and advocates for proactive measures to enhance student well-being, resilience, and academic success.

Keywords: Panic attacks, University students, Mental health, Academic stress, Coping strategies, Psychological support

Introduction

Panic attacks are sudden episodes of intense fear and physiological arousal that occur without warning and often without an identifiable trigger. Characterized by symptoms such as palpitations, shortness of breath, dizziness, and a sense of impending doom, panic attacks can severely disrupt an individual's emotional and cognitive functioning. Among university students, the prevalence of panic attacks has been rising, reflecting the growing psychological burden associated with academic, social, and personal stressors. University life presents a unique set of challenges that can predispose students to anxiety-related disorders. The pressure to perform academically, adapt to new social environments, maintain financial stability, and navigate personal identity development creates a complex landscape of stress. Studies have shown that students aged 18–25 are particularly susceptible to panic attacks due to heightened emotional sensitivity and transitional life stages (Son et al., 2020; Guan & Cao, 2023). Despite the increasing recognition of mental health issues in higher education, panic attacks remain underdiagnosed and undertreated. Many students do not seek professional help due to stigma, lack of awareness, or limited access to psychological services. This gap in support contributes to deteriorating academic performance, social withdrawal, and long-term emotional instability. The present study aims to investigate the prevalence of panic attacks among university students, identify key risk factors, and evaluate the effectiveness of coping strategies. By integrating local survey data with international research findings, this paper seeks to provide a comprehensive understanding of panic attacks in academic settings and offer evidence-based recommendations for prevention and intervention. The findings are intended to inform educators, mental health professionals, and policy-makers in developing targeted support systems that enhance student well-being and resilience.

Methods

Study Design and Participants

This study employed a descriptive cross-sectional survey design to assess the prevalence, risk factors, and coping strategies related to panic attacks among university students. A total of 150 students from various academic disciplines participated in the study. Participants were selected using convenience sampling from undergraduate and postgraduate programs at Nakhchivan State University and affiliated institutions.

Data Collection Instrument

Data were collected using a structured, anonymous online questionnaire developed via Google Forms. The questionnaire consisted of both closed-ended and multiple-choice questions divided into five sections:

- Demographic Information (e.g., age, gender, education level, field of study)

- Personal Experience with Panic Attacks
- Identified Risk Factors
- Coping Strategies
- General Opinions and Recommendations

The questionnaire was reviewed by two clinical psychologists and a public health expert to ensure content validity and clarity.

Data Analysis

Quantitative data were analyzed using descriptive statistics, including frequencies and percentages. The findings were presented in narrative form to facilitate interpretation.

Participants aged 18 and above, currently enrolled in a university program, and who provided informed consent were included. Incomplete responses and individuals with a diagnosed psychiatric disorder unrelated to panic attacks were excluded from the final analysis.

Results and Analysis

Among the 150 participants surveyed, 63.3% reported having experienced at least one panic attack, whereas 36.7% stated that they had never experienced a panic attack. These findings indicate that panic attacks are relatively common among university students and may represent a significant mental health concern within this population.

Among participants who reported experiencing panic attacks, 78.8% indicated that such episodes occurred rarely. In contrast, 13.9% experienced panic attacks several times per month, while 7.3% reported weekly occurrences. These results suggest that although panic attacks are widespread among students, recurrent episodes are less common.

The study population consisted predominantly of undergraduate students. Bachelor's degree students represented 91.3% of respondents, whereas only 8.7% were enrolled in Master's or higher-level academic programs. This distribution reflects the predominance of undergraduate students within the sample.

Several factors were identified as potential contributors to panic attacks. The most frequently reported factor was prolonged screen time and physical inactivity (44.7%). Academic stress was the second most common factor (27.3%), followed by family history of panic-related disorders (13.3%). Other contributing factors accounted for 14.7% of responses.

Participants reported using a variety of coping mechanisms to manage panic attacks. The largest proportion (42%) indicated that they did not seek any professional assistance. Breathing exercises and meditation were utilized by 19% of respondents, while physical activity was reported by 16%. Only a small proportion sought professional psychological or medical support.

Conclusion

Statistical analysis confirms that panic attacks are prevalent among university students, especially females and undergraduates. The most significant risk factors are academic stress, poor sleep hygiene, and excessive screen exposure. Despite the availability of coping strategies, most students lack access to professional support. These findings highlight the urgent need for institutional mental health services, awareness programs, and structured interventions such as CBT and mindfulness training.

Discussion

The findings of this study confirm that panic attacks are a prevalent psychological issue among university students, with 63.3% of respondents reporting personal experience. This rate is consistent with global trends, where young adults aged 18–25 are increasingly affected by anxiety-related disorders due to academic pressure, social transitions, and lifestyle disruptions (Son et al., 2020). The gender disparity observed—86% of respondents being female—also aligns with existing literature indicating that women are more susceptible to panic and anxiety disorders (McLean et al., 2011). The predominance of undergraduate students (91.3%) among respondents suggests that early academic stages may be particularly stressful, especially when combined with limited coping resources and high expectations. Risk factors such as prolonged screen exposure (44.7%), academic stress (27.3%), and poor sleep hygiene reflect the modern student lifestyle. These factors are known to dysregulate the autonomic nervous system and exacerbate anxiety symptoms (Guan & Cao, 2023). The low rate of professional help-seeking (only 16% receiving any form of support) highlights a critical gap in mental health infrastructure within academic institutions. Coping strategies like physical activity, breathing exercises, and meditation were commonly used, yet only 38% of students found them highly effective. This suggests that while self-help methods are accessible, they may not be sufficient without structured psychological interventions. Cognitive Behavioral Therapy (CBT), as demonstrated by Hofmann et al. (2012), remains one of the most effective approaches for panic disorder management.

The study emphasizes the need for universities to implement proactive mental health programs, including regular screenings, psychoeducation, and access to trained professionals. Integrating mental health awareness into academic culture can reduce stigma and encourage early intervention, ultimately improving student well-being and academic outcomes.

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PEDAGOGICAL SCIENCES

TEACHING LANGUAGE THROUGH A SINGLE COUPLET: A MICRO-READING APPROACH

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Abstract

This short article proposes the Single-Couplet Method as a micro-reading approach for foreign language teaching. The method is based on the pedagogical use of one carefully selected two-line poetic unit rather than a long literary text. It argues that a single couplet can function as a compact classroom material through which learners practise vocabulary, grammar, cultural interpretation and critical response within a limited lesson time. The article first explains why short literary forms may be more manageable than extended texts, then presents a three-layer model: lexical, grammatical and interpretive reading. It concludes that the single-couplet approach can make literary language accessible without reducing it to mechanical translation.

Keywords: couplet, foreign language teaching, micro-reading, vocabulary, grammar

1. Introduction

The use of literature in foreign language teaching has long been defended for its linguistic, cultural and motivational value. Literary texts expose learners to rich vocabulary, figurative language, varied syntax and culturally meaningful forms of expression. However, a practical difficulty remains: many literary texts are too long or too complex for beginning and intermediate learners. When a poem, story or classical passage is introduced without careful pedagogical reduction, the lesson may turn into either word-by-word translation or abstract literary commentary. In both cases, the language-learning function of the text can become weak.

This article proposes a solution to this problem: using one couplet as the basic unit of literary language teaching. A couplet, understood here as a two-line poetic or aphoristic unit, is short enough to be handled within a limited class period but dense enough to contain vocabulary, grammar, imagery and cultural meaning. The purpose of the article is not to present a large empirical study, but to outline a practical micro-reading model that can be adapted to different language classrooms. The model is especially useful in contexts where teachers want to connect language learning with literary and cultural awareness without overloading students.

2. Literature and the Need for Micro-Reading

Research on literature in language education generally emphasizes that literary texts should not be treated only as objects of literary history. They can also be used as authentic or semi-authentic materials for developing linguistic awareness, reading strategies and cultural interpretation. Lazar [1] argues that literature can support language teaching when teachers design activities that connect textual form with learner engagement. Similarly, Collie and Slater [2] present literature as a resource that can enrich classroom interaction and expose learners to meaningful language use. Later research also shows that literature in instructed language learning can generate productive classroom discussion and support both language and non-language outcomes [3].

At the same time, the use of literature requires selection. Long texts may be valuable, but they also demand time, linguistic preparation and interpretive competence. Hall [4] stresses that literature in language education should be approached through principles that are realistic for classroom practice rather than through purely canonical expectations. Hanauer [5] adds that poetry can create meaningful literacy because it connects language learning with personal and interpretive experience. These arguments suggest that the problem is not whether literature should be used, but how it can be scaled to the learner's level. Micro-reading offers such a scale. Instead of beginning with a whole poem or chapter, the teacher begins with a minimal but meaningful textual unit.

3. The Single-Couplet Method

The Single-Couplet Method is based on a simple assumption: a short poetic unit can become a complete language lesson if it is read through several layers. The teacher selects one couplet that is linguistically clear, culturally meaningful and appropriate for the learners ' level. The couplet does not need to come from one specific literary tradition. It may be selected from classical poetry, modern poetry, a proverb-like poetic form or a teacher-prepared literary sentence written in two lines. What matters is that the text should be short, memorable and semantically rich.

The method has three stages. The first stage is the lexical layer. At this level, students identify unfamiliar words, basic meanings, pronunciation and possible semantic associations. The aim is not to create a long vocabulary list, but to focus on a small number of high-value words. These words may include verbs, adjectives, abstract nouns or culturally loaded terms. Because the text is short, learners can return to the same

words several times and observe how meaning changes according to context.

The second stage is the grammatical layer. Here the teacher directs attention to the grammatical structure of the couplet: verb forms, tense, word order, pronouns, prepositions, connectors, possessive constructions or nominal phrases. The grammatical explanation should remain connected to the text. Instead of presenting grammar as an isolated rule, the teacher shows how grammar produces meaning in the couplet. For example, a conditional structure may express uncertainty, an imperative may create advice, and a possessive phrase may shape emotional relation. This stage helps learners see grammar as a meaning-making system rather than a set of mechanical forms.

The third stage is the interpretive layer. At this level, students discuss the image, metaphor, cultural reference or ethical question contained in the couplet. This is where literature becomes more than decoration. A short poetic unit may raise questions about love, time, knowledge, patience, exile, freedom or human limitation. Bobkina and Stefanova [6] argue that literary texts can support critical literacy when learners are encouraged to question meanings and positions in the text. In the single-couplet model, this critical dimension must remain brief and controlled. The goal is not to conduct literary analysis, but to move from language comprehension to thoughtful response.

4. Sample Classroom Application

The following teacher-prepared couplet may illustrate the model:

"When the road grows dark, the careful step
becomes a light;
When the heart grows still, the hidden word
becomes clear."

In the lexical layer, the teacher may select words such as road, dark, careful, step, light, heart, still, hidden and clear. Students first match these words with basic meanings and then group them into semantic fields: movement, perception and inner experience. In a different target language, the same procedure can be applied to the original words of the selected couplet. The shortness of the text allows students to repeat the words orally, use them in new sentences and notice contrastive pairs such as dark/light or hidden/clear.

In the grammatical layer, the teacher can focus on the repeated structure "when X becomes Y" or its equivalent in the target language. This structure is useful because it connects time, condition and transformation. Learners can then produce parallel sentences: "When the lesson becomes difficult, patience becomes necessary" or "When the text becomes familiar, reading becomes easier." In this way, grammar is practised through imitation and variation, not only through explanation.

In the interpretive layer, the teacher asks one or two short questions: What does "the careful step becomes a light" mean? Is the couplet saying that knowledge comes before action, or that action creates knowledge? Such questions invite students to interpret metaphor while staying close to the language of the text. The lesson can end with a written task in which students write one sentence about the meaning of the couplet or produce their own two-line text using the same grammatical pattern. The activity therefore moves from vocabulary to grammar, from grammar to interpretation, and from interpretation to production.

5. Conclusion

The Single-Couplet Method offers a practical way to use literary language in foreign language teaching without making the lesson too long or too abstract. Its main advantage is pedagogical economy: one short text can support vocabulary learning, grammar awareness, pronunciation, cultural discussion and written production. The method does not replace extended reading or systematic grammar teaching. Rather, it functions as a bridge between them. It allows learners to experience literary language as something readable, discussable and usable.

For teachers, the model also provides flexibility. The same three-layer sequence can be applied to different languages and literary traditions, provided that the chosen couplet is appropriate for the learners ' level. Future studies may test the model empirically by comparing learner engagement, vocabulary retention or interpretive writing before and after single-couplet activities. As a short pedagogical proposal, however, the method already indicates a simple principle: when the textual unit is small enough, literary language can become a manageable and meaningful part of language education.

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THEORETICAL FOUNDATIONS OF BUILDING A PERSONALIZED EDUCATION MODEL: TECHNOLOGICAL OPPORTUNITIES AND IMPLEMENTATION PROSPECTS

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Abstract

One of the primary challenges facing modern education systems is the creation of a more flexible and effective learning environment for learners with diverse educational characteristics. The rapid development of digital technologies, artificial intelligence (AI), and learning analytics has created favorable conditions for the widespread implementation of personalized education models.

A personalized education model aims to optimize the teaching and learning process by considering learners' individual characteristics, knowledge levels, interests, and learning pace. This article comprehensively analyzes the theoretical foundations, structural components, technological capabilities, and implementation mechanisms of personalized education. Particular attention is devoted to examining the role of artificial intelligence, adaptive learning systems, and learning analytics in the development of this model. Based on scientific studies conducted during the last decade, the article systematically presents the advantages, challenges, and future development directions of personalized education.

Keywords: personalized education, adaptive learning, artificial intelligence, learning analytics, digital education.

Introduction

The informationization of society and rapid technological advancement in the twenty-first century have led to fundamental changes in educational systems. For many years, traditional education models were based on standardized content and uniform teaching methods. Within this framework, all students were expected to acquire the same content through identical instructional approaches. However, contemporary pedagogical and psychological research demonstrates that students differ significantly in terms of cognitive characteristics, interests, learning speed, and motivation levels. Consequently, a single educational model cannot be equally effective for all learners [4,7].

At the same time, labor market requirements have evolved considerably. The global economy increasingly demands individuals who possess creative thinking, problem-solving, communication, and digital competencies. Therefore, the implementation of student-centered approaches has become a necessity. The personalized education model emerged as a response to these educational and societal transformations.

Personalized education involves designing an educational trajectory that reflects the individual characteristics of each learner. Within this model, students are not merely passive recipients of information but active participants in the educational process. Modern digital technologies, particularly artificial intelligence and big data analytics, have significantly expanded the practical possibilities of personalized education [1–3,12].

In recent years, many leading universities and educational institutions worldwide have begun implementing personalized learning systems. These systems analyze students' learning activities and provide individualized learning materials and assignments. Such an approach not only enhances instructional effectiveness but also positively influences student motivation.

What Should Constitute the Theoretical Foundations of Personalized Education?

1. Constructivist Approach

One of the principal theoretical foundations of the personalized education model is constructivist learning theory. According to this theory, knowledge is actively constructed by learners, and each individual relies on personal experience during the learning process. In this perspective, students are not passive listeners but central participants in learning.

Personalized education represents one of the practical applications of constructivist principles [13], as learners' experiences and interests are placed at the center of the educational process.

According to the constructivist approach:

- Knowledge is not transmitted in a ready-made form;
- Learning occurs through individual experience;
- Learners play an active role in the educational process;
- Teachers function as facilitators.

These principles constitute the methodological basis of personalized education.

2. Humanistic Pedagogy

The humanistic approach emphasizes individual potential and personal development. According to this perspective, educational systems should create conditions that facilitate self-actualization.

The personalized education model strengthens students' intrinsic motivation and enhances opportunities for self-expression [6]. Democratic relationships between teachers and students play a central role within humanistic pedagogy.

The main principles of the humanistic approach include:

- Respect for individual learner characteristics;
- Creation of an emotionally safe learning environment;
- Development of intrinsic motivation;
- Encouragement of creativity.

3. Cognitive Approach

Cognitive theories focus on the processes through which individuals process information. According to this perspective, learning is the result of cognitive activity. Within personalized education systems, the cognitive approach allows consideration of students':

- Memory characteristics;
- Attention levels;
- Problem-solving abilities;
- Cognitive pace.

Modern adaptive learning systems provide personalized content based on these cognitive characteristics [9].

4. Self-Regulated Learning Theory

In contemporary education, the ability of students to manage their own learning processes is of critical importance. The self-regulated learning model develops learners' planning, self-monitoring, and self-assessment skills.

Research indicates that personalized education increases students' academic independence and sense of responsibility [11]. This contributes significantly to the development of lifelong learning competencies.

What Should Be Included in the Structure of a Personalized Education Model?

1. Individual Learning Trajectory

An individual learning trajectory is one of the fundamental elements of personalized education. For each learner, the following should be determined:

- Individual goals;
- Customized content;
- Appropriate instructional methods;
- Personalized assessment systems.

Researchers emphasize that individualized learning trajectories improve academic performance and increase learning motivation [10].

2. Adaptive Content and Adaptive Systems

Adaptive content refers to instructional materials that change according to students' learning performance. Modern AI systems analyze learners' mistakes and provide additional explanations and assignments tailored to their needs. Natural Language Processing (NLP) and machine learning technologies play a significant role in the development of adaptive educational systems [9].

The primary functions of adaptive systems include:

- Identifying learners' weaknesses;
- Delivering personalized assignments;
- Adjusting learning pace;
- Providing automated feedback.

3. Learning Analytics

Learning analytics involves the collection and analysis of educational data. These systems evaluate:

- Student activity;
- Assignment outcomes;
- Participation levels;
- Learning progress.

Researchers have highlighted that learning analytics technologies significantly enhance the effectiveness of personalized education [8].

4. Artificial Intelligence Technologies

Artificial intelligence serves as one of the primary technological pillars of personalized education. AI-based systems:

- Analyze student behavior;
- Provide personalized recommendations;
- Generate adaptive content;
- Conduct automated assessment.

Research findings indicate that AI-based systems improve both learning effectiveness and student satisfaction [5].

What Should Be the Stages of Implementing a Personalized Education Model?

1. Diagnostic Stage

At the initial stage, the following learner characteristics are identified:

- Knowledge level;
- Learning style;
- Motivation level;
- Technological competencies.

This stage provides the foundation for developing an individualized educational plan.

2. Planning Stage

During the planning phase, the following are determined:

- Educational objectives;
- Individual learning strategies;
- Assessment methods.

Modern Learning Management System (LMS) platforms facilitate the automation of this process.

3. Implementation Stage

At this stage:

- Adaptive platforms;
- Artificial intelligence systems;
- Digital educational resources

are integrated into the educational process. The system automatically modifies content according to student performance.

4. Monitoring and Assessment Stage

Formative assessment plays a key role within personalized education. Continuous monitoring enables educators to:

- Track learner development;
- Identify problems promptly;
- Optimize instructional processes.

Advantages of the Personalized Education Model

Contemporary research demonstrates that personalized education:

- Improves academic performance;
- Increases learner motivation;
- Develops creative thinking skills;

- Strengthens students' self-confidence [6];
- Promotes a student-centered learning environment;
- Enhances individual potential;
- Makes learning more flexible and effective.

Challenges and Areas for Further Development

1. Technological Challenges

Many educational institutions still lack the necessary technological infrastructure.

2. Teacher Preparation

Teachers' digital competencies are not always sufficient for implementing personalized learning approaches.

3. Financial Constraints

The deployment of artificial intelligence and adaptive learning systems requires substantial financial resources.

4. Ethical and Security Issues

The use of big data raises concerns regarding privacy and information security [12].

5. Development of a Unified Assessment Framework

An important challenge involves establishing criteria for comparing the performance of students who study the same subject through different educational trajectories. A unified assessment framework is required. For example, in our pilot implementation, weighting coefficients are applied based on diagnostic-stage outcomes.

Future Development Prospects

In the future, personalized education is expected to evolve further through the integration of:

- Generative artificial intelligence capable of creating new educational content;
- Virtual mentoring systems based on AI-driven guidance;
- Immersive learning technologies that enable active participation within simulated environments;
- Lifelong learning platforms.

Research suggests that AI-based personalized systems will become one of the core components of higher education institutions in the coming years [13].

Conclusion

The personalized education model represents one of the most significant directions in the development of modern educational systems. By taking into account learners' individual characteristics, this model creates a more effective and flexible learning environment. Artificial intelligence, adaptive systems, and learning analytics constitute the technological foundation of personalized education.

At the same time, successful implementation requires the development of technological infrastructure, strengthening teacher preparation, and the adoption of innovative educational policies. The widespread implementation of personalized education systems in the future will make a substantial contribution to improving the quality of education.

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THE MANIFESTATIONS OF NATIONAL AND SPIRITUAL AWAKENING IN THE WORKS OF JALIL MAMMADGULUZADEH

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Abstract

The aims of this article is to investigate the manifestations of national and spiritual awakening ideas in the creative works of Jalil Mammadguluzadeh, and to analyze the artistic reflection of society's social, cultural, and ideological problems within his aesthetics of critical realism. Simultaneously, the study aims to determine the impact of the educational and democratic perspectives formed by the author within the "Molla Nasraddin" literary environment on the process of national self-awareness. It further intends to provide a scholarly interpretation of the presentation of issues such as language, religion, education, women's liberation, and social justice in his works.

Furthermore, based on Mirza Jalil's dramatic and prose examples, the article systematically analyzes the interrelationship between national identity, the ideology of Azerbaijanism, and universal human values. It concludes by assessing the contemporary relevance of his literary heritage and its enduring influence on public discourse.

Methodology: In this study, a combination of literary-critical, biographical, historical-comparative, and scholarly-philological methods has been utilized to conduct the research

Novelty: The article provides a systematic analysis of Jalil Mammadguluzadeh's oeuvre within the context of national-spiritual awakening, substantiating the interplay between national identity, language, enlightenment, and social critique through a novel scholarly approach. Simultaneously, the Molla Nasraddin literary milieu is evaluated as an ideological platform instrumental in the formation of national consciousness.

Results: Jalil Mammadguluzadeh's work demonstrates how critical realism and satire can expose social problems, promote public enlightenment, and foster national awakening. His enduring legacy centers on national identity, the mother tongue, freedom, and justice, while the Molla Nasraddin literary movement significantly contributed to the development of Azerbaijani national consciousness.

Keywords: Critical realism, Molla Nasraddin, The Dead, My Mother's Book, The Gathering of Madmen, stories

Introduction. Jalil Mammadguluzadeh (1869-1932), known by the pen name Molla Nasraddin, was a leading Azerbaijani writer, playwright, journalist, and public intellectual, widely regarded as the founder of critical realism and satirical literature in Azerbaijan. His works offered incisive portrayals of social realities and significantly advanced the development of realist literature. Notably, his early allegorical verse drama "The Tea Service" (Çay dəstgahı, 1899) employed symbolic motifs to promote ideas of national awakening. Through his literary and public activities, Mammadguluzadeh made a lasting contribution to Azerbaijani literature and culture, leaving a legacy that continues to inspire scholarly interest and cultural development.

Analysis of the latest publications on this topic (2020-2026 sales)

The scholarly legacy of Jalil Mammadguluzadeh and the Molla Nasraddin journal has been extensively analyzed across biographical, socio-journalistic, and theoretical-literary dimensions. Chronologically and contextually, this research spans from personal historical environments to modern comparative analyses. Vasif Guliyev (Guliyev, 2021) examines the crucial socio-cultural role of Hamida Khanum Javanshir, highlighting her lineage from Karabakh khans and her enlightened background. Her intellectual partnership with Mammadguluzadeh in Tbilisi between 1905 and 1907 directly fostered the Molla Nasraddin educational milieu, shifting the perception of her from merely a writer's spouse to an active agent of the Enlightenment movement.

Expanding this legacy to an international scale, Gulbaniz Babayeva (Babayeva, 2023) traces the ideological and stylistic impact of the Molla Nasraddin school on the Turkish satirical press from the 1950s onward. Magazines ranging from Karakedi and Akbaba to contemporary publications like Leman adopted its critical tone to address systemic socio-political issues, such as corruption and economic hardship. Locally, the preservation of this heritage within mid-20th-century scientific discourse is analyzed by Gulnar Gasimli (Gasimli, 2023), who evaluates the centenary coverage of Mammadguluzadeh's literary realism and public contributions in the Elm va Hayat journal between 1960 and 1970.

Recent scholarship transitions these historical analyses into theoretical frameworks. Shafa Aliyeva (Aliyeva, 2025) offers a comparative critical realist study, investigating the motifs of "madness" and "genius" in Mammadguluzadeh's The Assembly of the

Mad alongside Anton Chekhov's Ward No. 6. Similarly, Yakut Akbay (Akbay, 2025) utilizes Mikhail Bakhtin's dialogic theories to interpret female empowerment in The Tale of the Village of Danabash, framing the protagonist Zeynab's polyphonic resistance to patriarchy as a reflection of Azerbaijan's early modernization. Synthetically, these studies demonstrate that Mammadguluzadeh's legacy remains a dynamic subject of biographical, cross-border publicist, and contemporary theoretical inquiry.

Main text. Jalil Mammadguluzadeh's literary career began in 1903 at the Tiflis newspaper Sharqi-Rus, which published his debut stories and Tolstoy translations. Following the 1905 revolution, he founded the highly influential satirical magazine Molla Nasraddin. Championing the Azerbaijani national liberation movement, the publication used sharp satire to combat absolutism and support constitutional revolutions across Iran and Turkey. By addressing the masses directly and critiquing societal stagnation, Molla Nasraddin played a pivotal, progressive role in the socio-political history of the Caucasus and the Near East. (Mir Jalal, Huseynov, 1982: 81).

By launching Molla Nasraddin on April 7, 1906, Jalil Mammadguluzadeh – alongside key figures like M.A.Sabir and N.Narimanov – founded satirical journalism in the Turkic-Muslim world. Despite facing relentless Tsarist persecution and censorship, the magazine successfully promoted progressive democratic ideas, securing an enduring international legacy.

The satirical magazine Molla Nasraddin was published intermittently over 25 years across three cities, releasing 776 issues in total: 370 in Tiflis (1906-1918), 8 in Tabriz (1921), and 398 in Baku (1922-1931).

The magazine featured a compelling and diverse editorial agenda. Upon its debut, the inaugural issue introduced a comprehensive program that generated immense public excitement, structured around eleven core sections: scholarly articles, sharp critiques, feuilletons, satirical poetry and prose, humorous telegrams and announcements, anecdotes, interactive reader correspondence ("post box"), special notices, and editorial caricatures and illustrations. (Mir Jalal, Huseynov, 1982: 25).

Mirza Jalil's literary legacy is widely institutionalized in Azerbaijan through global translations, nationwide anniversary celebrations, and various monuments and house-museums. His name is commemorated across numerous streets and cultural institutions – including the Nakhchivan State Musical Drama Theatre and Literature Museum – alongside the toponymic renamings of Jalilabad and Jalilkend.

The National Leader's initiative to establish house-museums for prominent figures like Uzeyir Hajibeyli, Nariman Narimanov, Samad Vurgun, Huseyn Javid, and Jalil Mammadguluzadeh reflects the highest regard for Azerbaijan's cultural heritage. Among them, the writer and playwright Jalil Mammadguluzadeh held a special place. At the opening of the writer's house-museum in Baku in December 1994, Heydar Aliyev described his work as "an endless ocean" and stated: *"The opening of this museum is a symbol of high appreciation for Jalil Mammadguluzadeh's invaluable services to our history. There is no doubt that this cultural center will promote Mirza Jalil's genius and support our people on the path of moral purification and the struggle for independence"* (Heydar Aliyev's heartfelt words, 1994).

Jalil Mammadguluzadeh, a leading figure in Azerbaijani satirical literature, used his experiences as a rural teacher to expose social injustice, ignorance, and inequality through his writings and the magazine Molla Nasraddin.

The Adventures of the "Village of Danabash" (Danabaş kəndinin əhvalatları) (1894) portrays the exploitation of peasants and the abuses of local power, while "The Dead" (Ölülər) (1909) criticizes religious hypocrisy, superstition, forced marriage, and gender inequality, advocating social progress through the character of Iskandar.

After the Sheikh fled, it was Iskandar's turn. "*Look carefully at your history book – this will be a page written in blood. Those who come after you will turn these pages, see this one, remember you, and say: Shame on you… When the issue of resurrection was raised and Sheikh Nasrullah placed before you the power to revive the dead, you – who searched for angels in windows – did not agree to the resurrection of your dead brothers, sisters, wives, and children. Why? Why did you not agree? Because you beat your wives to death; because you married your brothers' wives; because you consumed the property of your dead friends' orphans – you did not agree for them to return to life and see your deeds and say: "Shame on you!'"* (Mammadguluzadeh, 1967: 54).

One of Jalil Mammadguluzadeh's greatest contributions was his service to the Azerbaijani language. His play "My Mother's Book" (Anamın kitabı), reflecting the idea of Azerbaijanism, promotes national unity, cultural roots, and preservation of the native language. Through the conflict among three brothers – each influenced by Russian, Iranian, or Ottoman culture – the author emphasizes the importance of protecting Azerbaijani national identity and language. (Mammadguluzadeh, 1967: 60).

Composed between 1926 and 1927, Jalil Mammadguluzadeh's work was later renamed "The Gathering of Madmen" (Dəlilər yığıncağı) and first published in Baku in 1938 by H.Samadzadeh. Although the plot is set in South Azerbaijan, its narrative and characters were drawn from real historical figures living in the "Madmen's quarter" of Nakhchivan. Characters such as Molla Abbas, Haji Jafar, Farmazon Rustam, and Mekka Mohammad were typified through Mirza Jalil's creative lens to serve his broader satirical and ideological purposes.

The work culminates in a profound speech by Molla Abbas. In the climax, Fazil attempts to legitimize the temporary marriage (sigheh) of his brother Molla Abbas's beautiful wife, Sona, under religious law. While the wives of other "madmen" comply and enter the litters to marry their brothers-in-law, the famously eccentric Pirpiz Sona refuses, exclaiming:

"Molla Abbas, I fear that because of these women who abandon their husbands for their brothers-in-law, the universe will collapse into chaos. Molla Abbas, I fear the stars will fall to the earth… Oh, look what I see… Molla Abbas, this is a gathering of madmen!" (Mammadguluzadeh, 1967: 147).

Mirza Jalil's literary works advocate for societal awakening, education, and progressive reform in Azerbaijan by exposing systemic oppression. In "The Dead" and "The Gathering of Madmen", characters like Iskandar and Molla Abbas symbolize the intellectual and spiritual triumph over a regressive world.

Conversely, Jalil utilizes sharp social satire to critique the feudal gentry and Tsarist administration. In "Gurbanali Bey", the protagonist personifies class-based injustice; he brutally mistreats his domestic servants while displaying abject servility toward Russian officials. This systemic exploitation of the peasantry is further symbolized by the village name "Gapazli" (slap) and echoed through corrupt figures like Khudayar Bey. Ultimately, as epitomized by the ignorant peasant Novruzali in The Post Box, Jalil's striking contrasts were designed to dismantle pervasive ignorance and champion civic rights.

Through satire, Jalil Mammadguluzadeh exposed social injustice, superstition, and religious hypocrisy. In works such as "The Post Box" (Poçt qutusu), "Usta Zeynal" (Usta Zeynal), "The Khan's Rosary" (Xanın təsbehi), and "The Raisin Game" (Kişmiş oyunu), he employed realistic characterization and concise irony to promote critical thinking and social awareness. Together with Abdurrahim bey Hagverdiyev and Suleyman Sani Akhundov, he played a key role in advancing Azerbaijani realist prose and expanding its thematic scope in the early twentieth century (Gasimov, 1993, p.138).

In "The Barber" (Dəllək) and "The Grain Doctor" (Taxıl həkimi) Mammadguluzadeh criticizes illiteracy and pseudo-intellectualism, while "The Bearded Child" (Saqqallı uşaq) and "Poetry Nightingales" (Şeir bülbülləri) expose social backwardness and the alienation of intellectuals from their native language and culture through irony and symbolism (Vahabova, 2014: 291). Mirza Jalil's realistic, highly observant short stories skillfully depict Azerbaijani life through vivid language and distinct Eastern humor. His work seamlessly bridges national identity with universal values – a feat requiring immense civic courage for his era – thereby serving as a foundational pillar for Azerbaijani national ideology (Speech of Heydar Aliyev, 1994).

Jalil Mammadguluzadeh's realism is deeply rooted in an objective representation of life. Rather than relying on explicit praise or condemnation, he reveals social realities through truthful and impartial depiction. Equally significant is his careful selection of titles, which closely reflect the content and thematic essence of his works. His prose titles may be grouped into four categories: ironic and colloquial titles (e.g., The Adventures of the Village of Danabash), titles based on personal names (e.g., Usta Zeynal), profession-based titles (e.g., The Barber), and titles that convey the author's critical perspective through figurative expressions (e.g., Poetry Nightingales and The Bearded Child) (Vahabova, 2014, p. 25).

According to Aziz Mirahmadov, Jalil Mammadguluzadeh's family donated his manuscripts and Molla Nasraddin archives to the Institute of Manuscripts. Later catalogued by M.C.Pashayev, these files revealed three unknown 1920s dramatic works – including "Curse" (Lənət) and "Gamblers" (Oyunbazlar) – which extend the author's critique of superstition, social backwardness, and failing educators (Aliyev, 2005: 273).

A prominent representative of the critical realist literary movement, Mirza Jalil wrote under the pen names "Molla Nasraddin," "Hop-hop," "Laghlaghi," "Deli," "Jizvizchi," "Hardamkhayal," and "Yuxusuz molla emi."

The great writer who signed his literary and publicistic works as Jalil Mammadguluzadeh and Molla Nasraddin, and who has been consistently identified as Jalil Mammadguluzadeh in all his books and biographical documents from his lifetime to the present, was given the name 'Mirza Jalil' by the people (Habibbeyli, 1994: 4).

Conclusion. The realism of Jalil Mammadguluzadeh gave rise to a major literary school founded on the ideals of freedom, enlightenment, democracy, and social progress. Through Molla Nasraddin, he promoted realist satire, simple and accessible language, and the creative use of Azerbaijani folklore, exerting a profound influence on many leading writers of his era. His humor was distinguished by its humanism and sympathy for ordinary people, particularly peasants, workers, and craftsmen, whose social conditions he portrayed with both realism and compassion. Mammadguluzadeh's works exposed ignorance, injustice, and social backwardness while advocating education and national awakening. His literary and ideological heritage continues to occupy an important place in Azerbaijan's cultural life, remaining a significant source of national consciousness, intellectual development, and modern civic values.

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SOCIOPRAGMATIC NATURE OF THE FEMALE PHENOMENON IN COMMUNICATION

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Abstract
The article reveals the status and roles in Uzbek communication on the example of women's speech, the speech of the elderly and children. It also analyzes the main purpose of the use of words and phrases that reflect the softness and sincerity and kinship inherent in the national culture of the Uzbek person, using evidence from a work of art. The social, national, cultural, and spiritual aspects of the subject of communication are studied. Attention is drawn to the fact that the hidden, unexpressed aspects of women's communication, characteristic of Uzbek culture, are hidden under softness and gentleness.

Keywords: communication, female phenomenon, nationality, permanent status, temporary status.

When we touch on the topic of women in dialogue, we must first of all dwell on the status of women, and status in general. At this point, O. Hashimov's aphorism about the mother comes to mind: "If we look at a woman, first of all, as a Mother, then everything falls into place". [6:88].

Status is the place occupied by a person in the social system, and a person has the rights and responsibilities corresponding to his place in this social system. There are such statuses that are given to a person from birth to death. These are nationality, gender, race. [2:26-27]. There are so many temporary statuses that it is impossible to count them, for example, a reader when entering a library, a passenger on public transport, a stranger in another city, a patient in the presence of a doctor, a student in the presence of a teacher, a comrade in the presence of friends, a buyer in the market, a host in the presence of guests. It should be noted that this temporary status requires moving under different mental, social, and cultural influences in different situations. Not taking them into account can harm a person. If a person goes to the market and preaches about being a scholar, the seller may drive him away. Because knowledge and wealth do not require each other, but rather oppose each other.

As with every person, a woman has permanent and temporary statuses. Permanent statuses are mother, spouse, and child (in front of her parents), and the status of a sister or younger sister in front of brothers and sisters is also considered permanent. Since the boundaries of permanent statuses are clear, it is relatively easy for individuals to control their speech in them. Since temporary statuses are limitless, it is clear that in the mental, social, and cultural situation inherent in hundreds and thousands of speech environments, it is not easy for human speech to speak based on this situation. Sometimes, even in settled status, there can be social or emotional barriers.

The Russians have an over and over again aphorism taken from Voltaire's poem. It says: "Kogda ledi govorit "net", ona hochet skazat "mojet bit", kogda lady govorit "mojet bit", ona hochet skazat "da", a yesli ona govorit "da", ona ne ledi" [7]. The content is as follows. If a woman says "no", she means "maybe". A woman's "maybe" means "yes". If a woman says "yes", she is not a lady".

So, women's control of their speech depending on the situation can prevent them from lowering their most stable status, which is femininity. [4:72-76].

Below, we will analyze how the speaker, in the image of a mother in a stable status, addresses her interlocutor in the interests of her child, and what goal she pursues in the choice of address. A conversation between a mother and a female teacher who grew up in the environment of Uzbek national culture:

Sentabrning oxirlarida G'aribning o'qituvchisi – kuykanakkina juvon eshik qoqib keldi. Uzoq hol-ahvol so'rashishidan va "oling-oling" qabilidagi manziratlardan so'ng, o'qituvchi:

– G'aribjon qayda, ovsin? Bir gaplashib olay degan edim, – dedi.

– Bilmasam, – dedi u yelka qisib.

– Menga aytmaydi, allaqayerlarga borib keladi. Kechqurun qaytadi, – dedi shikoyatomuz ohangda. – Nima, tag'in "ikki" oldimi? (I.Sulton. "Munojot").

(At the end of September, Garib's teacher, a young, knocked on the door. After a long inquiry about how he was doing and "take it, take it"-like greetings, the teacher said:

– Where is Garibjon, ***ovsin****? I wanted to talk to him, – she said.*

– If I don't know, – she shrugged.

– He doesn't tell me, he goes everywhere. He comes back in the evening, – said in a complaining tone. – What, did he get "two" again?)

The ovsin form of address used by the teacher in the quoted dialogue fragment serves as the initial step for the teacher to enter into a sincere dialogue with the mother of his student. In the Uzbek nation, women in the status of ovsin are usually women who communicate sincerely with each other, like friends, and sometimes, like daydreamers, who compete with each other. It is not for nothing that the proverbs "Ovsinim – ajinim, Ko'rganda kelar g'ijinim", "Ovsinlar inoq bo'lsa, Og'a-inilar chinoq bo'lmas" arose in our people. The conclusion drawn from the proverbs is this: They are competitors. They are ready to immediately point out each other's shortcomings.

Onaizor umidvor ko'zlarini juvonga tikib:

Endi nima qildik-a, singlim? – deb so'radi.

– Siz ko‘nglingizni tinch qiling, – dedi o‘qituvchi. Men undagi o‘zgarishlarning boisi nima ekanligini bilgani keluvdim, xolos. (I.Sulton. “Munojot”)

(*The mother looked at the young woman with hopeful eyes:*

What have we done now, sister? – she asked.

– You calm down, – said the teacher. I just came to find out what caused the changes in her)

The charm in the speech of the teacher and the student's mother, like a sister, which brings them closer spiritually, serves as a bond in the spiritual connection of the dialogue. We can also see from the continuation of the dialogue that the use of these forms of address helped to soften the situation and create a friendly atmosphere.

– Mening ichimdagi bor gap shunda ekan, – so‘zlanardi G‘arib. – O‘qib g‘alati bo‘lib ketdim.

– Aytmoqchi, o‘qituvchimiz keldimi?

– Sen qaydan bilding? – so‘radi ona.

– Bildim-da... Boya uyimizni so‘rovdi.

– Hoy, o‘tning yurganini qayda ko‘ruvding? – dedi ona. – Opangni rosa xafa qipsan-ku? Shuncha bergan darslarim kor qilmabdi, deb ketdi. (I.Sulton. Munojot).

(– That's what I'm saying, - said the G‘aribr. - I became strange after reading.

– By the way, has our teacher come?

– How did you know? - asked the mother.

– I knew... Now asked about our house.

– Hey, did you see how the grass is growing? – said the mother. – You really hurt your sister, didn’t you? She said that all the lessons I gave her didn’t hurt her)

In the dialogues cited, the kinship names *ovsin, singil, opa* are introduced into the text as a form of address by the participants. In this case, these kinship terms are used pragmatically and socially to manage the communication situation.

We understand the worldview of the **mother** in the example through the words she says, that is, through her request for advice, *Endi nima qildik-a, singlim?(What did we do, sister?*) In the work, the mother’s concern and anxiety about her child’s mental state is combined with her simplicity and sincerity, and it is seen in her appeal to her child’s teacher as if she were asking for help from a close sister.

Because “qualities such as cheerfulness, trustworthiness, simplicity, and kindness characteristic of Uzbek mothers” are reflected in the psyche of the mother’s image in the work. [4:122].

The purpose of the mother's sisterly treatment of the female teacher (towards the G‘arib) in the text is to teach her child to treat her teacher as a sister, not to offend her, and to treat this as disrespect for the teacher. This process is determined by the respect for the teacher in the national mentality. At the same time, it can be understood that this form of address is, under the text, an appeal to the child to study well. The form of address as a sister also evokes the content of respect in the characteristics of Uzbek national education. As a sign of closeness and respect towards a female teacher, the form of address as a sister also exists in the Andijan environment. We know well that in different social regions a female teacher is addressed differently. For example, “oye’ (mother) is used in Namangan, “opa” (sister) is used in Andijan, “opo‘ov” (sister) is used in Fergana, and in Khorezm, the same domla (sisterly) form of address is used for both female and male teachers. Under the influence of the Soviet regime, for a certain period of time, forms of address such as “*o‘rtoq*” (comrade) and “*tovarish*” (comrade) were also used.

“According to Uzbek national and cultural customs, we can often observe that women, even to express sincerity, address strangers or non-relatives as sister, daughter-in-law, owner, aunt, depending on their age.” [3:140].

Literary scholar I. Hakqul said: “Words educate a person. All positive and negative qualities inherent in a person are reflected in words.” [5:4]. In particular, in the lively speech of the Uzbek language, which is imbued with national education, we can see through many examples that the female and male images of the participants in their social roles acquire respect, softness and firmness. W. von Humboldt’s thoughts about the national spirit and the national language,“Language is, as it were, the outer appearance of the spirit of a people” [2:83] have not lost their validity over the centuries.

In studying the process of communication, it is necessary to pay special attention to the influence of national and social colorings on the speech of women and men. The sincerity in women's speech, as well as cunning, and adaptation to the environment for the benefit of their children and family, are noticeably reflected in their communication. In conclusion, female forms of address in communication convey the content of the message about the linguistic world to which the speaker belongs, its landscape, the characteristics of the territory in which she lives, and at the same time, the personal, individual world, and social identity of the speaker.

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BAKHTİYAR VAHABZADE THROUGH THE EYES OF THE ORİENTALİST SCHOLAR HANS AHMAD SCHMİD

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XALQ ŞAİRİ BƏXTİYAR VAHABZADƏ ŞƏRQŞÜNAS ALİM HANS ƏHMƏD ŞMİDENİN GÖZÜ İLƏ

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Abstract

The article examines the literary heritage of the People's Poet of Azerbaijan, Bakhtiyar Vahabzade, through the perspective of the German orientalist, Turkologist, translator, and literary scholar Hans Ahmad Schmiede. The aim of the study is to reveal H. A. Schmiede's views on Vahabzade's personality and creative work, as well as his contribution to the promotion of Azerbaijani poetry abroad. The article analyzes the scholar's prefaces, articles, and other materials devoted to the poet and identifies his scholarly assessment of the ideological and artistic features of Vahabzade's poetry.

The research demonstrates that H. A. Schmiede regarded Bakhtiyar Vahabzade not only as one of the most prominent representatives of Azerbaijani literature but also as an outstanding poet of the entire Turkic world. He highly appreciated the poet's ideas of patriotism, national self-awareness, love for the mother tongue, aspiration for freedom, and universal human values. Schmiede played an important role in introducing Vahabzade's works to readers in Germany and Türkiye. He translated a number of the poet's poems into Turkish and was among the first scholars to present Vahabzade and his literary achievements to Turkish readers. The article is also significant for the study of Azerbaijani–German and Azerbaijani–Turkish literary and cultural relations.

Xülasə

Məqalədə Xalq şairi Bəxtiyar Vahabzadənin yaradıcılığı alman şərqşünası, türkoloq, tərcüməçi və ədəbiyyatşünas Hans Əhməd Şmidenin baxışları əsasında araşdırılır. Tədqiqatın məqsədi

H. Ə. Şmidenin B. Vahabzadənin şəxsiyyəti və yaradıcılığı haqqında fikirlərini, eləcə də onun Azərbaycan poeziyasının təbliği sahəsindəki xidmətlərini üzə çıxarmaqdır. Məqalədə alimin şair haqqında yazdığı ön sözlər, məqalələr və digər materiallar təhlil edilir, Vahabzadə poeziyasının ideya-bədii xüsusiyyətlərinə verilən elmi qiymət müəyyənləşdirilir.

Araşdırma göstərir ki, H. Ə. Şmide Bəxtiyar Vahabzadəni yalnız Azərbaycanın deyil, bütövlükdə türk dünyasının görkəmli söz ustalarından biri kimi dəyərləndirmişdir. O, şairin əsərlərində əks olunan vətənpərvərlik, milli özünüdərk, azadlıq duyğusu, ana dilinə məhəbbət və ümumbəşəri ideyaları yüksək qiymətləndirmişdir. H. Ə. Şmide Vahabzadənin yaradıcılığının Almaniyada və Türkiyədə tanıdılması istiqamətində mühüm iş aparmış, şairin bir sıra əsərlərini türk dilinə tərcümə etmiş və onu türk oxucularına təqdim edən ilk tədqiqatçılardan biri olmuşdur. Məqalə Azərbaycan–Almaniya və Azərbaycan–Türkiyə ədəbi-mədəni əlaqələrinin öyrənilməsi baxımından da əhəmiyyət kəsb edir.

Keywords: Bakhtiyar Vahabzade, Hans Ahmad Schmiede, Azerbaijani poetry, literary translation, Turkish language, German Oriental studies, literary relations, Turkic world.

Açar sözlər: Bəxtiyar Vahabzadə, Hans Əhməd Şmide, Azərbaycan poeziyası, bədii tərcümə, türk dili, alman şərqşünaslığı, ədəbiyyatla əlaqəli, türk dünyası.

GİRİŞ

Xalq şairi Bəxtiyar Vahabzadənin şeirləri hələ sağlığında dünyanın müxtəlif dillərinə tərcümə edilmiş, şairin şeir və poemaları tədqiqatçıların diqqətini cəlb etmişdir.

Belə tədqiqatçı və tərcüməçilərdən biri, şərqşünas alim Hans Əhməd Şmidedir. Əhməd Şmide (almanca Hanspeter Achmed Schmiede) 1935-ci ildə anadan olmuş, 1957-ci ildə islamı qəbul etmiş, milliyətcə Prussiya əsilli almandır. Lakin onu islama bağlayan səbəb hər şeydən əvvəl türklərin müsəlman olmaları ilə baglıdır. O, gənc yaşlarından türk xalqlarının, o cümlədən Azərbaycan türklərinin tarixinə, mədəniyyətinə böyük maraq göstərmiş, ömrü boyu bu xalqın mədəni abidələrini tədqiq etmişdir. Əhməd Şmide Azərbaycan və Almaniya ədəbi-mədəni əlaqələrinin inkişafında müstəsna rol oynamış, Azərbaycan nağıllarını, "Kitabi-Dədə Qorqud"

("Dede Korkuds Buch") dastanını alman dilinə tərcümə etmiş, Azərbaycan ədəbiyyatı sahəsindəki səmərəli fəaliyyətinə görə Bakı Dövlət Universitetinin fəxri doktoru seçilmişdir.

Alman şərqşünası Əhməd Şmide Bəxtiyar Vahabzadə poeziyasını Türkiyədə və Almaniyada müntəzəm şəkildə təbliğ edən ilk və ən mühüm tərcüməçilərdən biridir.

Əhməd Şmide 1970-ci illərdən başlayaraq Türkiyədə çıxan nüfuzlu "Türk Edebiyatı" jurnalında və müxtəlif ədəbi mətbuat orqanlarında Vahabzadənin şeirlərini izahlı qeydlərlə Türkiyə türkcəsində çap etdirmişdir.

"AÇILAN SABAHLARA SALAM"

Bəxtiyar Vahabzadənin Türkiyədə tanınmasında Əhməd Şmidenin xüsusi rolu olmuşdur. O, 1977-ci ildə şairin seçmə şeirlərini türk dilinə tərcümə etmiş və "Açılan Sabahlara Salam" adı ilısanballı ön sözü Ankarada nəşr olunmuş "Açılan Sabahlara Salam" seçmə şeirlər Salam" adı ilə Ankarada nəşr etdirmişdir. Sərqşünas alim "Açılan Sabahlara Salam" kitabına-şeirlər toplusuna sanballı ön söz də yazmışdır. "Açılan Sabahlara Salam" kitabı Türkiyədə geniş rezonans doğurmuş, Vahabzadə poeziyasının türk oxuculara tanıdılmasında mühüm mərhələ olmuşdur (Vahabzade, 1977).

Kitabın ön sözündə Əhmıd Şmide qeyd edir ki, Bəxtiyar Vahabzadənin şeirləri yalnız Azərbaycan üçün deyil, bütün türk dünyası və insanlıq üçün böyük mənəvi dəyər daşıyır. Şərqşünas alim şairin yaradıcılığındakı milliliklə bəşəriliyin vəhdətini ön plana çəkir, Vahabzadənin həm tarixi köklərə bağlılığını, həm də çağdaş dünyanın fəlsəfi problemlərinə baxışını yüksək dəyərləndirir.

Əhməd Şmide tərcüməçi kimi, Vahabzadə poeziyasının dil xüsusiyyətlərinə xüsusi diqqət yetirmiş, bu şeirlərin fərqli dillərə tərcüməsinin həm cəlbedici, həm də məsuliyyətli olduğunu qeyd etmişdir.

Ön sözdə şairin Azərbaycan türkcəsinin saflığını qoruması və onu fəlsəfi fikrin zirvəsinə qaldırması unikal bir yaradıcılıq uğuru kimi təqdim olunur (Vahabzade, 1977).

Əhməd Şmidenin bu tərcüməsi sayəsində Bəxtiyar Vahabzadə hələ SSRİ dövründə - dəmir pərdələrin mövcud olduğu bir vaxtda Türkiyə ədəbi mühitində rəsmən tanındı və sevildi.

"Açılan Sabahlara Salam" kitabı və bu kitaba Əhməd Şmidenin yazdığı çox qiymətli ön söz Azərbaycanın müstəqillik ideallarının xaricdəki intellektual mühitə çatdırılmasında mühüm bir mədəni körpü rolunu oynadı.

Türkiyənin müxtəlif nəşriyyatları, Türkiyə Mədəniyyət nazirliyi şairin digər məşhur əsərlərini də ardıcıl olaraq kitab halında dərc etdilər: Qədim türk tarixindən bəhs edən "Özümüzü Kesen Kılıç" (Göktürkler) dram əsəri Türkiyə Mədəniyyət Nazirliyi tərəfindən Ankarada çap olundu və dövlət teatrlarında böyük uğurla səhnələşdirildi; "Gün Var Bin Aya Deger" şeirlər toplusu, "Gülüstan" irihəcmli poemalar toplusu, "Yücelikte Tenhalik" fəlsəfi-lirik şeirlər kitabı, " Vatan, Millet, Anadili" adlı araşdırma kitabı, " Nereye Gidiyor Bu Dünya", "Gurub Düşünceleri" adlı fəlsəfi topluları və s. nəşr olundu.

Görkəmli ədəbiyyatşünas və türkoloq Əhməd Şmide xalq şairi B. Vahabzadəni klassik ənənələrə bağli, sadə və anlaşıqlı dildə yazan realist sənətkar kimi qiymətləndirirdi.

Əhməd Şmide yazır: "Bir insanın öz xalqını və öz döğma dilini dəlicəsinə sevə bilmək qabiliyyətini mən B. Vahabzadədən öyrəndim. B. Vahabzadə realist şairdir. Dolaşıq və müəmmalı ifadələr, aydın olmayan tərkiblər və əllaməçilik onun sənətinə yaddır" (Vahabzadə, (Bib.), 2015, s. 37).

Ə. Şmide qeyd edir ki, Bəxtiyar Vahabzadənin yaradıcılığı qaranlıq təsvirlərdən tamamilə uzaqdır, onun şeirlərindəki ahəng və ifadə tərzi real həyata əsaslanır (Vahabzadə, 1977).

BƏXTİYAR VAHABZADƏ ALMAN DİLİNDƏ

1970-ci illərin əvvəllərində Azərbaycan Pedaqoji Dillər İnstitutunun alman –Azərbaycan dilləri ixtisasınıda təhsil alarkən institutun əsas korpusunda (o vaxtki Leytenant Şmidt küçəsi 58, indiki Rəşid Behbudov küçəsi) şifahi nitq laboratoriyasında sevimli şairimiz Bəxtiyar Vahabzadə və onun şəxsi dəvəti ilə Bakıya gəlmiş, Əhməd Şmide ilə görüşə bildim. Alman dili kafedrasının müdiri Sevda Pepinova, Bəxtiyar Vahabzadə uzaq Almaniyadan gəlmiş hörmətli qonaqla (bu, Əhməd Şmide idi) işgüzar söhbət edirdilər. Əhməd Şmidedən müsahibə almaq üçün Bəxtiyar müəllimdən icazə istədim (Əhməd Şmideni Azərbaycana B. Vahabzadə şəxsən dəvət etmişdi. Qonaq onun qonağı idi). Ə. Şmidedən aldığım müsahibə institutun çoxtirajlı "Bilik" qəzetində

(qəzetin redaktoru Zeydulla Ağayev) və "Azərbaycan gəncləri" qəzetində (o vaxt redaktor Qəşəm Aslanov idi) çap olundu.

Mənim almanca verdiyim "Nə üçün məhz Bəxtiyar Vahavbzadənin şeirlərini tərcümə edirsiniz"

sualına, gözləmədiyim halda, Əhməd Şmide şirin türk ləhcəsi ilə cavab vermişdi: "Bəxtiyar bəyin şeirləri oxucuya bəxtiyarlıq verir. Ona görə də onları türk və alman dillərində də oxuculara çatdırmaq istəyirəm" (Manafov, 2014).

Hans Əhməd Şmide hələ ötən əsrin 70-ci illərindən azərbaycanlı şairin şeirlərini alman dilinə çevirərək, Qərbi Berlin qəzetlərində çap etdirməyə başlamışdır.

Sonralar Hans Əhməd Şmide Bəxtiyar Vahabzadə yaradıcılığının əsl tədqiqatçısına, Vahabzadə əsərlərinin istedadlı tərcüməçisinə çevrildi.

Hans Əhməd Şmidenin alman dilinə tərcümə etdiyi şeirlər kitabı "Aus Karabag die Melodie..." ("Qarabağ mənim nəğməmdir") adı ilə İstanbulda Türk dünyası Araşdırmalar Vəqfi tərəfindən nəşr edildi. (Əsər Türk-Alman Mədəniyyət mübadilə Mərkəzinin (Berlin) birgə işidir) (Vahabzade, 1990).

Kitabda Bəxtiyar Vahabzadənin seçilmiş şeirləri, publisistik məqalələri və "İkinci səs" ("Die andere Stimme") pyesi verilmişdir.

Əhməd Şmide Bəxtiyar Vahabzadəni alman dilli oxuculara şair, dramaturq, nasir, publisist və siyasətçi kimi təqdim edir.

"Aus Karabağ dıe Melodie" ("Qarabağ mənim nəğməmdir") kitabı Bəxtiyar Vahabzadənin (öz dilindən) tərcümeyi-halı (Meine Autobioqraphie) ilə başlayir (Vahabzade, 1990, S. 4).

Sonra türk dünyasının böyük yazıçısı və bəşəri dəyərlərin tərənnümçüsü Cingiz Aytmatovun Azərbaycan şairinin misraları ilə başlayan " Die Zuversicht hat mich erschaffen, ich bin ein Kind der Zuversicht (" Yaradır inam məni, mən inamın övladıyam") adlı ön sözü – Azərbaycan şairinin yaradıcılığına dair fikirləri, düşüncələri verilir: " Bəxtiyar Vahabzadə şeirlərində zaman yaşayır - bizim qayğı yükümüzə tab gətirən, dərd-şərimizə şərik olan, qoynunda yaşadığımız zaman. Şeirlərin qüdrəti də bundadır..." (Vahabzade, 1990, S. 12).

" Aus Karabag die Melodie" ("Qarabağ mənim nəğməmdir") kitabı Bəxtiyar Vahabzadənin "Azərbaycan oğluyam" ("İch bin ein Sohn Aserbaidschans") şeiri ilə açılır. Bu ifadə Bəxtiyar Vahabzadənin yaradıcılığında çox mühüm olan milli mənsubiyyət və vətənpərvərlik ideyasını əks etdirir.

Əhməd Şmidenin tərcüməsində də bu ideyanın qorunmasına xüsusi diqqət yetirilmiş, müəllifin milli konsepsiyası uğurla qorunmuşdur.

Orijinal:

Azərbaycan oğluyam
Odu allah sanmışam.
Anam torpaq,
Atam od
Mən oddan doğulmuşam (Vahabzadə, 2004, s.32)

Alman dilinə tərcümə:

İch bin ein Sohn Aserbaidschans,
Hatte Feuer zum Gott eins erkoren.
Die Erde ist meine Mutter,
Das Feuer ist mein Vater.
Aus Feuer bin ich geboren (Vahabzade, 1990, S. 29)

Birinci misra – "Azərbaycan oğluyam" ifadəsi alman dilində "İch bin ein Sohn Azerbaidschans" kimi tərcümə olunub. Tərcüməçi orijinalın emosional yükünü qorumuşdur. Burada "Sohn" (oğul) sözü yalnız bioloji mənada deyil, mənəvi və vətəndaşlıq mənsubiyyətinin göstəricisi kimi çıxış edir. "Azərbaycan oğlu" ifadəsi milli mənsubiyyət, vətəninə bağlılıq ideyasını ifadə edir.

İkinci misra – "Odu Allah sanmışam"- tərcümədə "Hatte Feuer zum Gott einst erkoren" ("Bir zamanlar odu tanrı seçmişdim") kimi verilmişdir. Burada sözbəsöz tərcümə yoxdur. "Sanmışam" feili "erkoren" (seçmək, seçib qəbul etmək) ilə əvəz edilmişdir. Lakin semantik cəhətdən əsas fikir dəyişmir: odun müqəddəs sayılması qədim od inancına işarə edir və bununla tərcüməçi alman oxucusu üçün fikri daha aydın ifadə etməyə nail olur.

Üçüncü və dördüncü misralar:

Anam torpaq,
Atam od.

Alman dilinə tərcümə:

Die Erde ist meine Mutter,
Das Feuer ist mein Vater.

Bu misralarda Əhməd Şmide elliptik cümlələri (yarımçıq cümlələri) tam cümlələrə çevirmışdır. Bu, alman dilinin sintaktik funksiyalarına tam uyğundur.

Orijinal:

Mən oddan yaranmışam.

Tərcümədə:

Aus Feuer bin ich geboren

kimi çevrilmişdir, başqa sözlə, "yaranmışam" sözü əvəzinə, "doğulmuşam" (geboren) sözü işlədilmişdir. Bu işə poetik ifadəni alman dilində daha təbii səsləndirir. "Od"un, "atəş"in Azərbaycan insanının mənəvi mənşəyinin simvolu olması fikri dəstəklənir.

Əhməd Şmide orijinalın milli-mədəni simvollarını – "Azərbaycan", "od", "torpaq", "Allah" anlayışlarını qoruyaraq alman dilinin üslubu və sintaktik normalarına uyğun şəkildə tərcümə etmişdir.

Tərcümədə Vahabzadə poeziyasının əsas xüsusiyyətlərindən olan vətən sevgisi, milli özünüdərk və azadlıq duyğusu qorunmuşdur. Tərcüməçi mətnin ideya-məzmun səviyyəsində adekvatlıq prinsipinə üstünlük vermiş, Azərbaycan reallıqlarını alman oxucusuna anlaşıqlı şəkildə təqdim etməyə nail olmuşdur:

Bəxtiyar Vahabzadənin "Leben ist Brennen..." ("Yaşamaq yanmaqdır, yanasan gərək") misrası şairin həyat fəlsəfəsini ifadə edir.

Orijinal:

Yaşamaq yanmaqdır, yanasan gərək.
Həyatın mənası yalnız ondadır.
Şam əgər yanmırsa, yaşamır demək,
Onun da həyatı yanmağındadır.

Alman dilinə tərcümə:

Leben ist brennen, lass flammen dein Licht!
Darin allein liegt des Daseins Sinn.
İst kalt die Kerze, so lebt sie noch nicht;
Aufflammend kündet ihr Şchein; İch bin (Vahabzade, 1990, S. 24).

Birinci misrada "yanmaq" sözü məcazi mənada işlənərək insanın amal uğrunda yaşamasını, cəmiyyətə fayda verməsini və mənəvi fəaliyyətini simvolizə edir. Əhməd Şmide bu fikri alman dilində "Das Leben ist brennen..." ("Həyat yanmaqdır...") kimi tərcümə etməklə orijinalın semantik nüvəsini qoruyub

saxlamışdır. Lakin “yanasan gərək” hissəsi “lass flammen das Licht” (“qoy işıq alovlansın”) ifadəsi ilə əvəz edilmiş, orijinaldakı müracıət forması bir qədər dəyişdirilərək poetik obrazlaşdırılmışdır.

İkinci misrada “Həyatın mənası yalnız ondadır” fikri “Darın allein liegt das Daseins Sinn” kimi tərcümə edilmişdir. Əhməd Şmidenin “həyat“ sözünü daha fəlsəfi çalar daşıyan “Dasein”

(varlıq, mövcudluq) sözü kimi verməsi tərcüməyə əlavə fəlsəfi dərinlik qazandırır.

Üçüncü misrada “Şam əgər yanmırsa, yaşamır demək” fikri demək olar ki, tam ekvivalent şəkildə verilmişdir: “İst kalt die Kerze, so lebt sie noch nicht”. Əhməd Şmide “yanmırsa” sözünü “soyuqdursa” (“kalt”) sözü ilə ifadə edir. Bu, alman dilinin poetik imkanlarına uyğun uğurlu transformasiyadır (yanmayan şam, həqiqətən də “soyuq şam”dır).

Dördüncü misra maraqlıdır. Orijinalda: “Onun da həyatı yanmağındadır”.

Tərcümədə isə: “ Aufflammend kündet ihr Schein: “İch bin”. (Alovlanaraq onun işığı xəbər verir: “Mən varam”).

Əhməd Şmide bu misrada (dordüncü misra) poetik transformasiyaya müraciət edir, şam obrazı insan həyatının rəmzi kimi təqdim edilir, tərcüməçi şamın işığını danışdırır və onun dili “Mən varam” fikrini ifadə edir.

Ə. Şmide bu əlavəsi ilə Bəxtiyar şeirinin fəlsəfəsini alman oxucusuna daha təsirli şəkildə çatdırır.

Şeirdə “şam” özünü başqalarına işıq vermək naminə əridən insanın simvoludur. Tərcüməçi bu simvolikanı alman dilində də qorumağa çalışmış, nəticədə şeirin fəlsəfi və estetik təsir gücü zəifləməmişdir. Tərcümə məzmunun adekvat ötürülməsi prinsipi əsasında qurulmuşdur.

Beləliklə, Əhməd Şmidenin tərcüməsində orijinal mətnin əsas ideyası - həyatın fəallıq, fədakarliq və mənəvi yanğı üzərində qurulması uğurla saxlanılmışdır. Tərcüməçi sözbəsöz çevirmədən daha çox məna ekvivalentliyinə üstünlük vermiş və Bəxtiyar poeziyasının fəlsəfi dərinliyini alman dilli oxucuya çatdıra bilmişdir.

Daha sonra kitabda Bəxtiyar Vahabzadənin başqa məşhur şeirləri - “ Özümdən narazıyam...” (“Unzufrieden mit mir selbst...”), “Əks-səda” (“Echo”) və s. şeirləri, 3 pərdəli “ İkinci səs” (“Die andere Stimme”) dramı, şairin “Ədəbiyyat və incəsənət”, “Kommunist” və başqa qəzetlərdə dərc olunmuş, Garabağ həqiqətlərini dünyaya çatdıran publisistik yazıları, məktubları verilir (Vahabzade, 1990).

NƏTİCƏ

Aparılan araşdırma göstərir ki, Hans Əhməd Şmide Bəxtiyar Vahabzadə yaradıcılığının xarici ölkələrdə tanıdılması və təbliği sahəsində mühüm xidmətlər göstərmişdir. Alman şərqşünası və türkoloq alimin şair haqqında söylədiyi fikirlər, yazdığı məqalələr və qələmə aldığı ön sözlər Vahabzadə poeziyasının ideya-estetik dəyərinin obyektiv qiymətlndirilməsi baxımından xüsusi əhəmiyyət daşıyır. H.Ə. Şmide Bəxtiyar Vahabzadəni milli-mənəvi dəyərlərə sadıq, xalqının taleyi və gələcəyi haqqında düşünən böyük sənətkar kimi səciyyələndirmişdir.

Araşdırma nəticəsində müəyyən edilmişdir ki, Hans Əhməd Şmide təkcə Vahabzadə yaradıcılığının tədqiqatçisi deyil, həm də onun fəal təbliğatçısı olmuşdur. Alimin şairin əsərlərini türk dilinə tərcümə etməsi, onun haqqında elmi və publisistik yazılarla çıxış etməsi Bəxtiyar Vahabzadənin Türkiyədə tanınmasına və sevilməsinə əhəmiyyətli təsir göstərmişdir. Bu baxımdan H.Ə. Şmidenin fəaliyyəti Azərbaycan – Almaniya və Azərbaycan – Türkiyə ədəbi- mədəni əlaqələrinin inkişafında mühüm mərhələ kimi dəyərləndirilə bilər.

Bəxtiyar Vahabzadənin yaradıcılığına xarici alimlərin münasibətinin öyrənilməsi şairin beynəlxalq nüfuzunun müəyyənləşdirilməsi ilə yanaşı, Azərbaycan ədəbiyyatının dünya miqyasında təbliği yollarının araşdırılması baxımından da aktual elmi əhəmiyyət kəsb edir.

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PHYSICAL SCIENCES

REVEALING THE STRUCTURE OF MOTION DYNAMICS THROUGH SPATIAL-ENERGY PARAMETERIZATION

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Abstract

This paper examines the transition from the traditional temporal parameterization of classical mechanics to a spatial-energy interpretation within the framework of the Deterministic Theory of Mechanics (DTM). It is shown that Newton's second law admits an equivalent spatial-energy form: $F\,ds = mv\,dv$ The paper introduces the concept of the inertia level of a system: $I = mv$ and formulates the law of spatial change of the state of motion: $\chi(s) = \frac{F}{I(s)}$. According to DTM, motion is interpreted not merely as a temporal process but as a continuous causal-energy transformation of the dynamical state of a system. It is shown that as velocity increases, the inertia level of the system also increases, leading to a reduction in the spatial rate of change of the state of motion and to a nonlinear growth of energy expenditure required for further acceleration. The proposed approach preserves full mathematical compatibility with classical mechanics while extending its causal-energy interpretation.

Keywords: Deterministic Theory of Mechanics, spatial-energy parameterization, inertia level, dynamics, causal-energy interpretation, motion

1. Introduction

Classical mechanics, established in the works of Isaac Newton [1], traditionally relies on temporal parameterization of motion. The fundamental dynamical equation is expressed in the form:

$$\boldsymbol{F = m\frac{dv}{dt}}, \tag{1}$$

This formulation successfully describes the temporal rate of change of velocity and forms the foundation of classical dynamics.

Subsequent development of mechanics in the works of Euler [2], Lagrange [3], Hamilton [4], Arnold [5], and Landau and Lifshitz [6] significantly expanded the mathematical apparatus of mechanics through differential equations, variational principles, Hamiltonian formalism, and geometric methods.

Despite the high predictive power of classical mechanics, its standard interpretation remains primarily focused on temporal parameterization. In many cases, the causal-energy structure of motion and the role of the current inertial state of a system are not expressed explicitly.

The Deterministic Theory of Mechanics (DTM) proposes a spatial-energy interpretation of dynamics. Within this framework:

- motion is regarded as a continuous causal-energy process;
- force is interpreted as the primary causal factor;
- energy transfer represents the mechanism of change;
- and the dynamical evolution of a system depends on its current inertia level.

The purpose of this paper is to formulate the spatial-energy interpretation of mechanics, derive the corresponding form of Newton's second law, introduce the concept of the inertia level of a system, and analyze the law of spatial change of the state of motion.

2. Spatial-Energy Form of Newton's Second Law

Starting from Newton's second law:

$$F = ma, \tag{3}$$

and using the kinematic relations:

$$a = \frac{dv}{dt}, v = \frac{ds}{dt}, \tag{4}$$

we obtain:

$$a = \frac{dv}{dt} = \frac{dv}{ds} \cdot \frac{ds}{dt}, \tag{5}$$

Therefore:

$$\boldsymbol{a = v\frac{dv}{ds}}, \tag{6}$$

Substituting into Newton's second law yields:

$$\boldsymbol{F = mv\frac{dv}{ds}}, \tag{7}$$

Multiplying both sides by (ds), we obtain:

$$\boldsymbol{F\,ds = mv\,dv}, \tag{8}$$

In DTM, this equation (8) is interpreted as the spatial-energy form of Newton's second law.

The left-hand side represents the elementary work performed by the force:

$$\boldsymbol{dE = Fds}, \tag{9}$$

while the right-hand side describes the elementary change in the kinetic state of the system.

Within DTM, the equation:

$$\boldsymbol{F\,ds = mv\,dv}, \tag{10}$$

does not replace classical mechanics mathematically but shifts the interpretation of motion from purely temporal parameterization toward a causal-energy description of the dynamical process.

3. Axiomatic Foundations of the Deterministic Theory of Mechanics

The Deterministic Theory of Mechanics is based on several conceptual principles that define the causal-energy interpretation of motion.

3.1. Principle of Causal-Energy Nature of Motion

According to DTM, motion is interpreted as a continuous process of change in the energetic and inertial state of a system under the action of force.

3.2. Principle of Spatial-Energy Parameterization

DTM considers spatial-energy parameterization as a complementary form of dynamical description alongside temporal parameterization.

In this interpretation:

- the work of force is treated as the direct energetic cause of motion change;
- while the change of the state of motion represents the dynamical consequence.

3.3. Operational Status of Time

Within DTM, time is not treated as an independent physical object or primary cause of motion.

Instead:

- time performs the operational function of registering the sequence of changes in the state of a system.

3.4. Principle of Self-Consistency of Dynamical Systems

The evolution of a dynamical system is determined by the mutual relationship between:

- force; energy; inertia; and motion.

According to DTM, these quantities form a unified interconnected structure of the dynamical state of matter.

3.5. Mathematical Determination of the Dynamic Chain of Events

According to DTM, the dynamical process can be represented as a strict causal sequence:

$$\boldsymbol{F(s) \rightarrow E(F,s) \rightarrow v(E,s) \rightarrow \Delta s \rightarrow t(F,s)}, \quad (11)$$

where:

- $F(s)$is force as the primary physical factor;
- $E(F,s)$is the work of force (energy transfer);
- $v(E,s)$is velocity as a function of the energetic state;
- $\Delta s$is the spatial change of the state of motion;
- $t(F,s)$is the temporal registration of the sequence of states.

Within this framework:

- force acts as the primary causal factor;
- energy represents the mechanism of state transformation;
- motion is the consequence of energetic and inertial change;
- and time represents the registration of state sequence rather than the fundamental cause of dynamics.

4. Inertia Level of a System

DTM introduces the concept of the inertia level of a system:

$$\boldsymbol{I = mv}, \quad (12)$$

which is quantitatively equivalent to the magnitude of momentum.

According to DTM:

- inertial properties belong not only to mass;
- but also to the current dynamical state of the system.

As velocity increases: $\boldsymbol{I = mv}, (12)$ also increases.

Consequently, the resistance of the system to further changes in its state of motion becomes greater.

Within DTM, inertia level is interpreted as a quantitative characteristic of the current inertial state of motion.

5. Law of Spatial Change of the State of Motion

From $\boldsymbol{F = mv\frac{dv}{ds}}$ it follows that:

$$\boldsymbol{\frac{dv}{ds} = \frac{F}{mv}}, \quad (13)$$

DTM defines the spatial rate of change of the state of motion as:

$$\boldsymbol{\chi(s) = \frac{dv}{ds}}, \quad (14)$$

Therefore:

$$\boldsymbol{\chi(s) = \frac{F}{I(s)}}, \quad (15)$$

This relation is referred to in DTM as the law of spatial change of the state of motion.

According to this law:

- The spatial rate of change of velocity is inversely proportional to the current inertia level of the system.

This means that:

- under the same force;
- systems with larger inertia levels undergo slower spatial change of their dynamical state.

6. Energy Interpretation of Motion Change

To illustrate the proposed interpretation, consider equal velocity increments: $\Delta v = 10$ m/s for a body of mass $m = 1$ kg.

The kinetic energy is given by:$E_k = \frac{mv^2}{2}$. The energy required for identical velocity increments at different initial velocities is presented in Table 1.

Table 1.

Energy required for the same velocity increment at different initial velocities

Initial velocity interval (m/s)	Energy increment (J)	Relative energy cost
0 → 10	50	1×
10 → 20	150	3×
20 → 30	250	5×
30 → 40	350	7×
40 → 50	450	9×

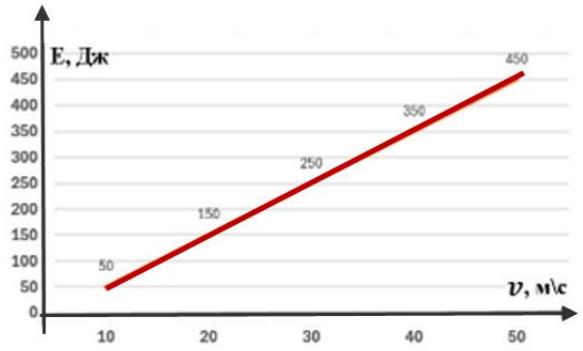

Figure 1. Dependence of the kinetic energy increment on the initial velocity for a fixed velocity increment m/s (kg).

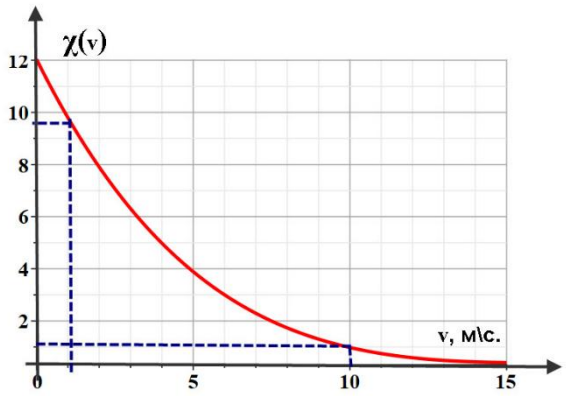

Figure 2. Dependence of the spatial rate of change of the gravitational field velocity χ on the body's velocity v.

Figure 1 shows the dependence of the increment of kinetic energy ΔE on the initial velocity v_0 for a fixed change in velocity Δv = 10 m/s (for mass m = 1 kg). Figure 2 presents a detailed graph depicting the functional dependence of the spatial velocity of change of the state of motion χ on the velocity of the material point v.

This graphical interpretation allows for a visual analysis of the dynamics of change in the parameter χ, identification of characteristic features of the curve, and evaluation of the behavior of the physical system over a wide range of values of the velocity modulus v.

The results demonstrate that:

- Identical changes in velocity require increasingly larger amounts of energy as the initial velocity grows.

According to DTM, this effect is related to:

- growth of the inertia level;
- and reduction of the spatial rate of change of the state of motion.

Thus, motion change becomes energetically more difficult at higher velocities.

7. Distinction Between Gravitational Field Strength and Spatial Rate of Motion Change

Within DTM, an important conceptual distinction is made between:

- gravitational field strength;
- and the spatial rate of change of the state of motion.

In classical mechanics: $g = \frac{F}{m}$ characterizes the intensity of the gravitational field.

However, according to DTM, the actual spatial rate of change of motion is determined by:

$\chi(s) = \frac{F}{I(s)}$, (15) and therefore depends not only on force but also on the current inertia level of the system.

This distinction suggests that:

- field characteristics;
- and dynamical response characteristics represent different physical categories.

Within DTM:

- gravitational field strength describes the external physical influence;
- whereas the spatial rate of motion change characterizes the dynamical response of the system.

8. Limiting Character of Motion

As velocity approaches high values, the inertia level increases substantially:

$$I = mv$$

As a consequence:

$$\chi(s) = \frac{F}{I(s)}$$

approaches smaller values.

Therefore:

- increasingly greater energy input is required to produce further changes in the state of motion.

Within DTM, this tendency may be interpreted as indicating the existence of natural energetic limitations in high-velocity dynamics.

The proposed interpretation does not contradict classical mechanics mathematically, but emphasizes the energetic and inertial structure of dynamical processes.

9. Discussion

The Deterministic Theory of Mechanics does not attempt to replace the mathematical structure of classical mechanics.

Instead, DTM proposes:

- an alternative causal-energy interpretation of dynamics;
- a spatial-energy parameterization of motion;
- and an explicit description of the role of inertia level in the evolution of dynamical systems.

In standard classical mechanics:

- motion is usually expressed through temporal rates;
- whereas DTM additionally considers the spatial-energy structure of the process.

The proposed approach emphasizes that:

- motion change depends not only on the applied force;
- but also on the current inertial state of the system.

Within this interpretation:

- force; energy; inertia; and motion

form a unified interconnected dynamical structure.

The proposed framework may be useful for:

- conceptual analysis of dynamical systems;
- methodological studies in mechanics;
- analysis of inertial processes;
- and spatial-energy modeling of motion.

10. Conclusion

The Deterministic Theory of Mechanics (DTM) proposes a spatial-energy interpretation of classical dynamics by extending the traditional temporal parameterization of motion with a causal-energy description of dynamical processes.

In the present work, the following concepts were introduced and analyzed:

- the spatial-energy form of Newton's second law;
- the inertia level of a system;
- the law of spatial change of the state of motion;
- and the principle of mathematical determination of the dynamic chain of events.

Within the proposed framework, motion is interpreted as a continuous process of transformation of the energetic and inertial state of a system under the action of force.

It was shown that:

- the dynamics of motion depends not only on the magnitude of the applied force;
- but also, on the current inertia level of the system.

As velocity increases:

- the inertia level rises;
- the spatial rate of change of the state of motion decreases;
- and the energetic cost of further acceleration grows nonlinearly.

The graphical analysis presented in Figures 1 and 2 demonstrates:

- the nonlinear growth of energy expenditure with increasing velocity;
- and the decrease in the spatial rate of change of the state of motion as the inertia level increases.

The proposed approach preserves full mathematical compatibility with classical mechanics while providing an explicit causal-energy interpretation of motion and inertial processes.

According to DTM:

- force; energy; inertia; and motion

form a unified interconnected structure of the dynamical state of matter.

The proposed framework may be useful for further conceptual and methodological investigations in mechanics, inertial processes, and spatial-energy modeling of dynamical systems.

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Conflicts of Interest

The authors declare no conflict of interest.

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POLITICAL SCIENCES

EXECUTING SECURITY? THE DEATH PENALTY AND THE POLITICS OF FEAR IN ISRAEL

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Abstract
The renewed debate on the death penalty in Israel highlights the tension between security concerns and human rights commitments in times of crisis. This article argues that capital punishment functions more as a political response to fear than an effective deterrent to terrorism.

Keywords: Death Penalty, Israel, Human Rights, Democracy, Terrorism, Rule of Law, Abolition, Security

Introduction. The abolition of the death penalty is often regarded as one of the most significant human rights achievements of the modern era. Across Europe, capital punishment has become incompatible with democratic governance and respect for human dignity. Yet recent developments in Israel demonstrate how quickly long-standing commitments can be challenged when societies face violence, insecurity and collective trauma.

Following the October 7 attacks and the ongoing conflict in the region, political support for expanding the use of the death penalty has re-emerged in Israel. Advocates argue that terrorism requires exceptional responses and that the gravest crimes deserve the gravest punishments. However, the renewed debate raises a deeper question: is the death penalty truly a tool of security, or has it become a political response to fear? The answer matters far beyond Israel. It speaks to a broader global trend in which democratic societies increasingly struggle to balance security concerns with fundamental rights and the rule of law.

The Politics of Fear. History demonstrates that moments of crisis often reshape criminal justice policy. Terrorist attacks generate understandable public anger, grief, and demands for accountability. Political leaders are frequently pressured to demonstrate strength and resolve. In such circumstances, harsher punishments can become politically attractive, regardless of whether they effectively address the underlying threat.

The Israeli debate illustrates this dynamic. Calls for capital punishment intensified following one of the deadliest attacks in the country's history. For many supporters, the issue is framed as a matter of justice for victims and deterrence against future attacks. Yet this framing risks reducing a complex security challenge to a symbolic act of punishment.

The death penalty has long occupied a unique place in political discourse because it allows governments to communicate toughness and determination. Executions can be presented as decisive action. However, symbolism should not be confused with effectiveness. Public demand for severe punishment does not automatically translate into sound public policy.

Does the Death Penalty Deter Terrorism? One of the central arguments advanced by supporters of capital punishment is deterrence. The assumption is simple: if potential offenders know they may face execution, they will be less likely to commit violent acts.

Yet decades of research have failed to establish a clear connection between the death penalty and lower rates of serious crime. The argument becomes even weaker in the context of terrorism. Terrorist violence is often driven by ideological commitment, political objectives, religious extremism, or a willingness to sacrifice one's own life for a cause. Individuals motivated by such factors are unlikely to be deterred by the threat of execution.

In some circumstances, executions may even reinforce extremist narratives. Organizations frequently portray convicted individuals as martyrs, using their deaths as propaganda tools for recruitment and mobilization. If the objective is to reduce terrorism, evidence suggests that intelligence gathering, prevention strategies, and effective law enforcement are far more valuable than capital punishment.

This raises an uncomfortable question: if the death penalty does not demonstrably improve security, why does it remain politically appealing?

Democracy Under Pressure. The answer may lie not in security policy but in political psychology. Fear creates a demand for certainty and capital punishment offers the illusion of a definitive solution. It transforms a complex challenge into a visible act of state power.

However, democratic values are tested precisely during periods of crisis. Human rights protections are easiest to defend when public opinion is calm and stable. Their true significance emerges when fear, anger, and insecurity create pressure to abandon them.

The debate surrounding the death penalty therefore extends beyond criminal justice. It concerns the resilience of democratic institutions themselves. If exceptional circumstances justify exceptional punishments, where should the limits be drawn? Can a democracy remain committed to universal human rights if those rights become conditional upon political circumstances?

For abolitionists, these questions are fundamental. The rejection of capital punishment is based not only on concerns about wrongful convictions or deterrence but also on the belief that the state should not deliberately take human life as a form of punishment. This

principle does not become less important during times of conflict; rather, it becomes more important.

A Global Warning. Israel is not the only country experiencing renewed calls for harsher punishment. Around the world, governments increasingly invoke security concerns to justify exceptional measures. The rise of populist politics, polarization, and democratic backsliding has contributed to a broader shift toward punitive approaches.

In this context, the Israeli debate serves as a warning. Once capital punishment is reintroduced into mainstream political discourse, the boundaries that previously protected abolitionist achievements become less secure. The danger is not only the possibility of future executions but also the normalization of the idea that human rights can be suspended whenever societies face extraordinary challenges.

The strength of a democratic system should not be measured by how severely it punishes its enemies. It should be measured by its ability to uphold justice without abandoning its fundamental values.

Conclusion. The renewed discussion of the death penalty in Israel is often presented as a debate about security. In reality, it is also a debate about democracy, human rights, and the political power of fear. While the desire for accountability following acts of terrorism is understandable, the death penalty offers little evidence of increased security and carries profound ethical and legal consequences.

The question facing democratic societies is therefore not whether they can execute those who commit horrific crimes. The question is whether they can resist the temptation to do so when fear and anger are at their highest. The future of abolition may depend on how that question is answered.

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PSYCHOLOGICAL SCIENCES

PHYSICAL TRAINING STRUCTURE AND THE DEVELOPMENT OF MOTOR ABILITIES IN ADOLESCENT VOLLEYBALL PLAYERS

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Abstract

Purpose: This study examined the effects of a structured physical training programme on the development of motor abilities in adolescent volleyball players. The study also aimed to identify the key physical components that contribute to volleyball-specific performance.

Methods: A quasi-experimental design was applied with adolescent volleyball players divided into control and experimental groups. The experimental group followed a structured training programme focused on speed, explosive strength, coordination, agility, and endurance, while the control group continued traditional training. Motor abilities were assessed through sprint, shuttle-run, vertical jump, standing long jump, coordination, and volleyball-specific accuracy tests.

Results: The findings showed greater improvements in the experimental group compared with the control group. The most notable progress was observed in speed-strength indicators, jumping ability, agility, and coordination. Factor-based interpretation indicated that explosive strength, general strength, speed, muscular endurance, and coordination were the main components of physical preparedness in adolescent volleyball players.

Conclusion: Structured and scientifically planned physical training has a positive effect on the development of motor abilities in adolescent volleyball players. Training programmes for youth volleyball should integrate strength, speed, agility, endurance, and coordination exercises rather than developing these qualities separately.

Keywords: adolescent volleyball players, motor abilities, structured training, explosive strength, coordination

INTRODUCTION

Modern volleyball is characterized by a clear specialization of player roles, including the setter, outside hitter, middle blocker, opposite hitter, and libero. The libero position, officially introduced by the FIVB in 1998, significantly influenced the tactical structure of the game and increased the specialization of defensive actions.

In school sports, systematic volleyball training contributes to the comprehensive physical development of adolescents. Physical preparation forms the basis for improving motor abilities, supporting technical and tactical performance, and enhancing overall functional capacity. The effectiveness of sports training depends on the integrated development of technical, tactical, physical, and psychological components, which function as a unified system during competitive activity [3, 9].

Studies indicate that successful volleyball performance requires the development of strength, speed, agility, coordination, and endurance [5]. These qualities ensure effective movement execution, stability of motor skills, and adaptation to changing game situations. Therefore, sports training should simultaneously focus on technical mastery and the improvement of physical abilities.

Physical Preparation of Adolescent Volleyball Players

Physical preparation is a key component of sports training aimed at developing strength, speed, endurance, agility, and coordination abilities [1, 2]. It includes general and specific physical preparation. General physical preparation provides the functional foundation necessary for balanced physical development, while specific preparation focuses on abilities directly related to volleyball performance [4, 8].

Research demonstrates that physical preparation is closely connected with technical and psychological development. Therefore, training programs should ensure the harmonious development of all motor qualities rather than emphasizing a single component. Excessive focus on one quality may negatively affect the development of others and reduce overall athletic performance [5].

Strength and Speed Abilities in Volleyball

Strength is defined as the ability to overcome external resistance or resist it through muscular effort [2, 11]. In volleyball, strength abilities play an important role in jumping, attacking, blocking, and serving actions. Depending on the demands of the sport, strength may be expressed as maximal strength, speed-strength, or strength endurance.

Speed abilities determine the efficiency of movement execution and reaction to game situations [7]. Their assessment is usually based on reaction time, acceleration capacity, and maximum movement speed [12, 13]. A particularly important manifestation of speed in volleyball is the ability to stop rapidly and change movement direction, which enables athletes to respond effectively to dynamic game conditions.

Endurance, Flexibility, and Coordination Abilities

Endurance is one of the most important components of athletes' physical preparation, ensuring the maintenance of performance capacity and resistance to fatigue during training and competition [2]. Sports science distinguishes between general endurance, which is based mainly on aerobic energy supply and supports long-term work capacity, and specific endurance, which reflects the ability to perform effectively under the particular conditions of competitive activity.

Flexibility, defined as the ability to perform movements with a large range of motion, depends on the elasticity of muscles and connective tissues, joint structure, and neuromuscular regulation [13]. Adequate flexibility contributes to efficient movement execution, injury prevention, and the development of technical skills. It is generally classified into dynamic and static flexibility.

Coordination abilities are essential for successful volleyball performance because they enable athletes to react quickly, maintain spatial orientation, and execute movements accurately under constantly changing game conditions [13]. The level of coordination is closely associated with agility, neuromuscular control, and the ability to adapt movements to situational demands.

Methodological Approaches to Physical Training

The development of physical qualities in sports training aims to improve functional capabilities, strengthen the musculoskeletal system, and enhance sport-specific performance. Strength development occupies a central role in this process and is achieved through both general and sport-specific exercises, including bodyweight training, resistance exercises, jumping drills, and movements performed with additional loads. The most commonly used methods involve repeated efforts with submaximal loads, maximal and near-maximal efforts, static exercises, and combined training approaches designed to improve overall athletic performance.

Methods for Developing Physical Qualities in Volleyball

The development of physical qualities in volleyball requires an integrated approach that combines speed, endurance, flexibility, and coordination training. Speed development is based on improving both simple and complex motor reactions through sprint exercises, game situations, and sport-specific drills that simulate competitive conditions. Effective speed performance depends not only on reaction time but also on the interaction of strength, coordination, and neuromuscular control.

Endurance training aims to maintain performance capacity and delay fatigue during prolonged training and competition. In volleyball, particular emphasis is placed on speed endurance and the ability to recover quickly between high-intensity actions. Training programs therefore incorporate repetitive exercises with controlled workloads and rest intervals to improve both aerobic and anaerobic capacities.

Flexibility development is achieved primarily through dynamic and static stretching exercises that increase joint mobility, improve movement efficiency, and reduce injury risk. Modern training practice widely employs stretching techniques during warm-up, main training, and recovery phases.

Coordination abilities are developed through repeated and variable exercises performed under changing conditions. Such methods improve balance, spatial orientation, movement accuracy, and the ability to adapt technical actions to unpredictable game situations. The use of sport-specific drills that replicate competitive demands contributes to the development of specialized perceptual abilities and enhances overall movement control.

Assessment of Physical Preparation

The level of physical preparation was evaluated through tests measuring strength, speed, endurance, flexibility, and coordination abilities [7,13, 14]. Strength indicators included maximal and speed-strength performance, while speed abilities were assessed through reaction time and movement velocity tests. Coordination abilities were evaluated using tasks requiring movement accuracy, balance, spatial orientation, and adaptation to changing conditions. Endurance was assessed through sport-specific and general functional tests reflecting the athletes' ability to maintain performance over time.

Physical Preparation and Motor Skills

Physical preparation and technical skill development are closely interconnected. Research demonstrates that improvements in strength, speed, endurance, and coordination positively influence the formation and execution of motor skills. Effective volleyball performance depends on the balanced development of physical qualities and technical proficiency, which function as a unified neuromuscular system.

Structure and Programming of Physical Preparation

Modern sports training increasingly relies on scientifically based programming approaches that optimize training loads and improve performance. The analysis of physical preparation in adolescent volleyball players identified five key components: jumping readiness, general strength, speed, muscular endurance, and coordination. Together, these factors form the basis for effective technical and tactical performance and should be considered when designing training programs.

Research Objectives

The objectives of this study were:

To determine the movement characteristics of adolescent volleyball players during official competitions.

To identify the physical qualities associated with effective game performance.

To examine the structure of physical preparation in adolescent volleyball players.

To develop and evaluate a programmed approach to physical preparation during the preparatory training period.

Research Methods

The study employed the following methods:

Analysis and synthesis of scientific literature;

Anthropometric measurements;

Pedagogical observation and testing;

Assessment of physical and motor abilities;

Mathematical and statistical analysis.

Speed abilities were assessed using short-distance sprint tests (3 m, 6 m, and 9 m) and shuttle-running tasks. Speed-strength abilities were evaluated through medicine-ball throws and vertical jump tests. Coordination abilities were assessed through reaction and movement-control tasks.

Organization of the Research

The study involved 70 adolescent volleyball players with official sports qualifications. The research was conducted in three stages. Initially, scientific literature was reviewed and assessment criteria were selected. Subsequently, pedagogical observations and experimental measurements were carried out to evaluate physical preparation and movement activity. The collected data were then analyzed to determine the structure of physical preparation and to assess the effectiveness of the proposed training approach.

In the second stage of the study, a determinative pedagogical experiment was conducted involving 36 adolescent volleyball players. The participants' physical preparation levels, playing roles, and age-related characteristics were evaluated, and the relationships between physical qualities, competitive performance, and the structure of physical preparation were determined. Based on the obtained results, a specialized set of exercises was developed to improve the physical preparation of adolescent volleyball players (Table 1).

Table 1

№	Names and Execution of Movements	Number of Repetitions	Number of Sets
1	From a squatting position, quickly stand up and rise onto toes (with barbell). The barbell weight is 30% of the maximum capacity.	10–12	4–5
2	Jumps from a squatting position (with barbell). The barbell weight is 30% of the maximum capacity.	10–12	4–5
3	Jumps with knees bent at 90º–100º (with barbell). The barbell weight is 30% of the maximum capacity.	20–25	3–4
4	The same movement on one leg. The barbell weight is 20–25% of the maximum capacity.	25–30	3–4
5	Sitting on the floor, throw a 5 kg filled ball with both hands from behind the head to the marked zone.	20	–
6	While jumping in place, throw a tennis ball over the net to zone five (imitating an attack hit).	30	–
7	Repeat the same movement after running and jumping, throwing the ball over the net.	20	–
8	After jumping down from a platform 70–80 cm high, jump upward imitating an attack hit.	15	–
9	From standing or after a run-up, jump upward with a two-foot push and touch a hanging ball with your hand.	15	–
10	On the coach's signal, after a 3–4 m acceleration, imitate an attack hit in zones 2, 3, or 4.	15	–
11	After performing a side fall movement, accurately pass the ball with both hands a distance of 7–9 m.	8–10	–
12	Perform the same movement after a forward somersault.	8–10	–
13	Partner exercises: jump and rotate 360º while passing the ball. The partner performs the same movement.	15 each side	–
14	Two forward somersaults followed by an attack hit after receiving a pass from a partner.	10	2
15	From a gymnastics springboard, jump upward imitating an attack hit.	20	–

A pedagogical experiment involving 24 adolescent volleyball players was conducted to evaluate the effectiveness of the proposed physical preparation program. Participants were assigned to control and experimental groups with similar baseline characteristics. The control group followed the standard training program, whereas the experimental group applied the proposed approach. The motor ability indicators of the control group are presented in Table 2.

Table 2

Comparison of Initial and Final Results of Physical Activities

Type of Movement	Initial Result	Final Result	Difference	Percentage (%)
Shuttle run 30m “9-3-6-3-9” (sec)	10.5	9.5	1.0	10.5
Hitting the target (square) with an attack strike from 3m distance (times)	15-7	15-9	2	28.6
Vertical jump from standing position with double-leg push-off (cm)	38	42	4	11.1
Shuttle run 10x10m (sec)	27.5	25.5	2.0	7.5
20m sprint (sec)	3.6	3.4	0.2	5.3
Running 5x6 (5 times) (sec)	13.0	12.8	0.2	12.5
Side jumps over a gymnastics bench within 30 sec (times)	30	34	4	5.1
Standing long jump (cm)	160	175	15	14.4

During the pedagogical experiment, unlike the control group, the adolescent volleyball players in the experimental group conducted their training based on the program we had developed. The pedagogical experiment lasted from September 2023 to May 2025.

Indicators determining the level of development of motor abilities in adolescent volleyball players. Indicators of the adolescent volleyball players in the experimental group (Table 3).

Table 3.

Comparison of Initial and Final Results of Physical Activities

Type of Movement	Initial Result	Final Result	Difference	Percentage (%)
Shuttle run 30m “9-3-6-3-9” (sec)	10.0	8.0	2.0	10.5
Hitting the target (square) with an attack strike from 3m distance (times)	15-8	15-12	2	28.6
Vertical jump from standing position with double-leg push-off (cm)	40	46	6	10.7
Shuttle run 10x10m (sec)	26.5	24.0	2.5	6.5
20m sprint (sec)	3.8	3.3	0.5	4.8
Running 5x6 (5 times) (sec)	12.8	12.6	0.2	5.4
Side jumps over a gymnastics bench within 30 sec (times)	32	39	7	8.5
Standing long jump (cm)	155	185	30	28.4

Results

The results showed that volleyball performance is characterized by frequent jumping, rapid movements, and changes of direction, resulting in high physical demands on athletes. Match intensity increases with the number of sets, particularly in five-set games, highlighting the importance of physical preparation.

The analysis revealed significant relationships between strength, speed, and coordination abilities. Five key components of physical preparation were identified: jumping ability, strength, speed-agility, endurance, and coordination. Based on these findings, a programmed training approach was developed to improve the physical preparedness of adolescent volleyball players.

Conclusion and Recommendations

The findings indicate that the physical preparedness of adolescent volleyball players is determined primarily by the development of jumping ability, strength, speed-agility, endurance, and coordination. The experimental program contributed to improvements in these indicators, particularly in jumping performance and strength endurance.

Given the increasing intensity of modern volleyball, training programs should be systematically planned and adapted to the age and individual characteristics of athletes. Special attention should be paid to the integrated development of coordination, speed-strength, and endurance abilities, as these qualities form the basis for effective technical and tactical performance.

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THE IMPACT OF ENVIRONMENTAL FACTORS ON TEACHER BURNOUT SYNDROME: REVIEW ANALYSES

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Abstract

Burnout is a syndrome characterized by emotional exhaustion, depersonalization, and decreased personal accomplishment. Because the teaching profession requires constant self-sacrifice, effective communication, and is emotionally draining, it is considered one of the professions where burnout is highly likely to occur.

In the model regarding teachers' burnout, it was observed that the variables "educational status" for the emotional exhaustion subscale, "socioeconomic status of the school's location" for the depersonalization subscale, and "gender" and "branch" for the personal achievement subscale significantly contributed to whether the burnout score placed the teacher in the high or low group. According to literature review, male teachers scored higher than female teachers in the emotional exhaustion, depersonalization, and personal achievement sub-dimensions.

Professional seniority is another variable that affects teachers' burnout. Indeed, teachers with 6-10 years of seniority experience higher levels of emotional exhaustion and depersonalization, while their perceptions of personal achievement decrease accordingly. This result is the opposite for teachers with 21-25 years of professional seniority. These teachers, who experience lower levels of emotional exhaustion and depersonalization, have higher perceptions of personal achievement.

Keywords: burnout syndrome, social-economical impact, teachers and educators, mental health, well-being.

Introduction

As a concept, burnout was used by scientists in the 1960s to describe chronic drug addiction. However, it began to become widespread when a psychologist named Herbert Freudenberger (1980) used the term "burnout syndrome" to describe a condition resulting from overworking. Researchers have defined the concept of burnout in many different ways since the 1970s. For example, Pines and Aronson (1988) pointed to a series of symptoms such as "physical exhaustion, feelings of helplessness and hopelessness, experiencing disappointment, developing a negative self-concept, and harboring negative feelings towards one's work, colleagues, and life in general" to define burnout syndrome. Advanced burnout seriously hinders an individual's ability to adapt to their environment. Maslach (1976) states that employees lose interest in their work and colleagues and may harbor hostile feelings towards them. On the other hand, Mattingly (1977) considers burnout as a series of symptoms, behaviors, and attitudes that manifest themselves in a way unique to each individual. Freudenberger and Richelson (1980) also address the concept of burnout as fatigue or a state of disappointment towards a goal, lifestyle, or relationship. The common point of these assessments regarding the concept of burnout is that it weakens the individual and makes it difficult for them to adapt to life. At this stage, it can be said that hopelessness is an appropriate concept in defining burnout. Research also shows that there is no fixed level of burnout, and that the state of burnout can range from "mild burnout" to "severe burnout". Burnout is seen as an accelerator of a number of serious problems in the teaching profession. “Frequent absenteeism, low level of commitment to work, illness, physical discomfort, inappropriate behavior, and poor teaching performance” can be listed as negative situations that may arise in the teaching profession (Huberman & Vandenberghe, 1999; Rudow, 1999). Cordes and

Dougherty (1993) suggest that burnout can lead to physical and mental problems, disruptions in social and family life, the development of negative behaviors, and an increased risk of smoking, drug use, and alcohol use.

Teacher Burnout

Burnout is a syndrome characterized by emotional exhaustion, depersonalization, and decreased personal accomplishment (Maslach and Jackson, 1981). It can be said that burnout is most common among teachers compared to other professions. This is because the teaching profession is one that constantly demands sacrifice, requires effective communication, and emotionally exhausts the individual. Therefore, the teaching profession is considered one of the professions where burnout is highly likely to occur (Baltaş & Baltaş, 1993). Many structural and organizational factors are effective in teacher burnout, such as the decrease in public trust in education, the gap between teachers' expectations in pre-service training, and their classroom experiences (Dworkin, 2001). There is increasing pressure on teachers to be more knowledgeable and effective in their profession. In addition, teachers have other responsibilities that are expected of them beyond academic expertise. On the other hand, teachers also work with students who have many emotional and behavioral problems. Many teachers experience difficult moments due to insufficient resources in meeting the individual needs of their students.

According to Dorman (2003), burnout seriously harms teachers' ability to continue their work.

When teachers experience this syndrome, they begin to harbor negative emotions. They experience communication breakdowns with their students and with their fellow teachers. Thus, the teacher's private life may also suffer, and health problems may arise.

There are findings in the literature showing that teacher burnout is an increasingly common and significant problem in educational institutions. In some studies conducted abroad regarding teacher burnout, the relationships between job stress, job satisfaction, self-efficacy beliefs, and the depression caused by the imbalance between effort and reward have been revealed (Dorman, 2003; Farber; 2000; Mykletun & Mykletun, 1999). Especially since the mid-1990s, it has also been examined in studies within the country (Babaoğlan, 2007; Cemaloğlu & Şahin, 2007; Erçen, 2009; Gündüz, 2005; Otacıoğlu, 2008; Kırılmaz, Çelen & Sarp, 2002; Peker, 2002; Tuğrul & Çelik, 2000; Tümkaya, 1996). Teachers experiencing burnout may encounter many problems with their students, colleagues, administrators, students' parents, in short, all components of the education system, and therefore they gradually become disillusioned with their profession.

Teachers are expected to cope with the numerous problems they encounter in their profession on their own. However, teachers need to feel good and successful about themselves and their abilities; in other words, they need motivation. Only in this way can they make their students feel the same. If teachers feel unsuccessful and dissatisfied, this can harm their relationships with students and even the entire school. Teacher burnout is a contagious problem. If there are teachers experiencing burnout in a school, the entire school will soon begin to experience the same feelings. Therefore, it is one of the important problems that needs to be prevented. Burnout, examined in a wide range of educators from university lecturers to kindergarten teachers, has been addressed within the framework of various demographic, professional, and psychological variables. Research generally focuses on the causes of burnout in teachers and measures to alleviate it. In some of these studies, participants' age, satisfaction with the environment, outlook on professional future, gender, education level, and length of service are considered as key variables. The stress and burnout experienced by teachers have significant effects on families, administrators, students, and parents—in short, the entire society—and are reflected directly or indirectly throughout society (Friedman & Farber, 1992). Rapid changes are occurring in social life. In this context, the roles and responsibilities of teachers, as well as expectations of them, are also changing. These expectations affect teachers' perspectives on their work life and their performance. Therefore, the continuation of research into burnout, which is so important in the lives of teachers and consequently in society as a whole, and the examination of its relationship with different variables, can be considered an important phenomenon. It is thought that examining the levels of emotional exhaustion, desensitization towards students, and decreased sense of achievement in teachers is important in terms of revealing the general situation regarding burnout in teachers. Thus, burnout, which has been the subject of many studies but cannot be prevented, can be examined from new perspectives in light of changing social structures, and different solutions can be developed. For this purpose, this study aims to reveal the general situation regarding burnout feelings among teachers and to examine the relationship between burnout feelings and various demographic variables.

Burnout may not manifest the same way in every teacher, but there are some common symptoms that appear similarly in most people. These symptoms increase over time and deepen if ignored. The following are among the most common symptoms of burnout in teaching:

- ✓ Feeling anxious or reluctant before entering the classroom;
- ✓ Decreased motivation towards the lesson, becoming mechanical while teaching;
- ✓ Intolerance and impatience with minor problems;
- ✓ Disconnection in communication with students or colleagues;
- ✓ Feeling inadequate, ineffective, or unsuccessful;
- ✓ Constant fatigue, exhaustion, and inability to rest despite sleep;
- ✓ Lack of interest in things you used to enjoy;
- ✓ Increased self-talk such as "How much longer can I keep this up?"

Causes of Burnout:

- ✓ Loneliness;
- ✓ Pressure;
- ✓ Inadequacy.

Burnout in education cannot be reduced solely to individual causes. Teaching is shaped not only by what happens in the classroom, but also by the unseen expectations imposed by the system. Constantly striving for performance, being innovative, meeting the needs of every student, maintaining harmony with parents and administration… All these burdens can cause teachers to unknowingly deplete their own resources.

Loneliness, however, is the quietest companion to burnout in teachers. Professional burnout is not something a teacher should deal with alone, but it is often experienced as if it were. If everyone around you is silent, you learn not to speak either. In an environment where expressing your concerns is considered "causing trouble," teachers often take refuge in silence.

Another deep-seated cause is a feeling of inadequacy. A teacher who feels they haven't made a difference despite doing their best begins to question their own worth over time. Burnout in teachers grows right in the middle of this questioning.

Distinguishing Physical and Emotional Fatigue-Fatigue often passes with a night's sleep. But burnout doesn't; on the contrary, it deepens over time. You wake up in the morning, you have no physical problems, but you don't want to go to class. Your energy feels drained; even if you have the strength to teach, you lack the desire. This isn't ordinary tiredness; it's a deeper form of exhaustion.

Emotional exhaustion is a rather silent process for teachers. Withdrawing into oneself, being unable to connect with students in the classroom, or finding that details once important no longer hold any meaning are natural parts of this process. Teacher fatigue often stems from the fact that while the system constantly expects us to "give," what we give remains invisible.

What Can Be Done to Overcome This Feeling?

The first step is to not view this situation as merely temporary fatigue. Burnout in teachers can only transform when it is recognized, accepted, and reflected upon. For this, the teacher must first be honest with themselves: being able to say, "I'm really not okay," is a healing statement in itself. From this point, it's possible to progress in small steps by recognizing personal needs and limitations.

Stress management in teaching isn't just about time management. The real issue is how emotional burdens are carried and where they are left behind. Therefore, teachers must first and foremost learn to create space for themselves. To stop, think, and seek support if necessary. This is where coaching comes in. Coaching allows teachers to access not only their professional skills but also their inner resources.

If you are considering seeking professional support, you can find some tips to help you decide in my article titled "Should I Get Coaching Services?".

Is it Possible to Cope with Emotional Loneliness in Teaching?

Many teachers find it difficult to express their emotions. This is because emotions are perceived as unprofessional in educational environments. However, burnout most affects those who remain silent. When a teacher begins to say, "I put in so much effort, but I don't get anything in return," they have reached an emotional threshold. When this threshold is crossed, some teachers consider leaving the profession, while others simply continue with an automatic routine.

Loss of motivation in teaching cannot be explained solely by a lack of attention. It is often the result of feeling misunderstood, unappreciated, and unseen. Therefore, it is important for teachers to make this loneliness visible, both for their own well-being and for the sustainability of educational environments. Teachers who enter the professional development process with coaching support not only become aware of their burnout but also have the chance to restructure their internal motivation. In short, you can overcome the problem of burnout in teachers with coaching support.

Is it possible to reverse burnout? The answer to this question is a definite yes, but conditional: if the will to change this situation can be shown. Burnout in teachers can be developed and transformed over time. The important thing here is that the transformation process is carried out patiently and with awareness. Just as no one becomes burned out overnight, no one recovers overnight. But with the right support, a teacher can begin to hear their own voice again.

In this process, a personal professional development plan becomes an important tool for the teacher. This plan covers not only what to teach, but also how to teach feelingly, and when the teacher rebuilds their self-respect, they become not only a good teacher, but also a person at peace with themselves.

Recommendation

This study concluded that teachers have higher levels of burnout (in all sub-dimensions) than other group of population. A thorough investigation into the reasons for this situation is recommended. On the other hand, teachers' educational level affects their burnout. Teachers with higher educational levels are observed to have lower levels of burnout. Based on this finding, creating various opportunities for teachers to develop themselves personally and professionally could have positive results. Therefore, academic development opportunities can be created for teachers. The results regarding the type of school where teachers work and the region where the school is located show that the resources available to the school have an effect on burnout. Based on this finding, it can be said that improving the resources of schools, especially in low socio-economic regions, will have a significant benefit in raising the quality of education.

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TECHNICAL SCIENCES

EFFECT OF A MIXTURE OF SWEET CLOVER, ST. JOHN'S WORT AND PURSLANE EXTRACTS ON THE ANTIOXIDANT ACTIVITY OF YOGURT

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Abstract

The use of plant extracts in the production of functional dairy products is one of the relevant directions in modern food technology. Plant extracts can increase the nutritional and biological value of yogurt and improve its antioxidant properties. This study investigated the effect of **a mixture of sweet clover,** St. John's wort and purslane extracts on the antioxidant activity of yogurt. The extract mixture was added to yogurt in an amount of 1 ml. The ratio of plant components in the mixture was 35:35:30, 35:30:35 and 40:25:35. Yogurt without added extracts was used as a control sample. The results showed that the addition of plant extract mixtures increased the antioxidant activity of yogurt. The TEAC value of the control yogurt was 50.80 μmol TE/g, while the fortified yogurt samples showed values ranging from 63.00 to 74.03 μmol TE/g. The highest antioxidant activity was observed in yogurt enriched with the mixture of sweet clover, St. John's wort and purslane extracts at a ratio of 35:30:35. In this sample, the TEAC value reached 74.03 μmol TE/g, which was approximately 45.7% higher than that of the control sample. The obtained results indicate the prospects of using a mixture of sweet clover, St. John's wort and purslane extracts as a natural functional additive in yogurt production. This mixture can increase the antioxidant potential of yogurt and contribute to expanding the range of functional dairy products.

Keywords: yogurt, sweet clover, St. John's wort, purslane, plant extracts, antioxidant activity, TEAC, functional dairy products.

Introduction

Currently, the development of functional food products is one of the important areas of the food industry. Consumer demand for products enriched with natural components and biologically active substances is increasing. In this regard, the enrichment of dairy products, including yogurt, with plant extracts is considered a relevant technological approach [1].

Yogurt is a fermented dairy product with high nutritional value, good digestibility and a beneficial effect on the intestinal microflora. It contains proteins, fats, vitamins, minerals and lactic acid microorganisms. However, in modern functional food technology, special attention is paid not only to the nutritional value of yogurt, but also to improving its antioxidant and biologically active properties [2, 3].

Plant extracts contain phenolic compounds, flavonoids, organic acids, vitamins and other biologically active substances. These components can increase the antioxidant activity of the product and enhance its functional significance [4, 5]. The use of medicinal plant extracts in yogurt production is an effective way to introduce natural functional additives into dairy products [6].

Sweet clover, St. John's wort and purslane are plants rich in biologically active compounds. Sweet clover contains coumarins and phenolic compounds; St. John's wort is rich in flavonoids and substances with antioxidant activity; purslane is known as a source of vitamins, organic acids and natural antioxidants [7, 8]. The use of these plant extracts in the form of a mixture can improve the functional properties of yogurt.

The aim of this study was to evaluate the effect of a mixture of sweet clover, St. John's wort and purslane extracts on the antioxidant activity of yogurt and to determine the most effective ratio of plant components.

Materials and methods

Yogurt samples enriched with a mixture of plant extracts were used as the object of the study. Yogurt without added extracts was used as the control sample. Experimental samples were prepared by adding a mixture of sweet clover, St. John's wort and purslane extracts.

The extract mixture was added to yogurt in an amount of 1 ml. The ratio of plant components in the mixture was 35:35:30, 35:30:35 and 40:25:35. These ratios characterize the percentage share of sweet clover, St. John's wort and purslane extracts in the mixture.

The antioxidant activity of yogurt samples was determined using the ABTS method [9]. The results were calculated as Trolox equivalent antioxidant capacity (TEAC) and expressed as μmol TE/g. The obtained values were compared with the control sample in order to evaluate the effect of the plant extract mixture on the antioxidant activity of yogurt.

Results and discussion

The results of evaluating the effect of mixtures of sweet clover, St. John's wort and purslane extracts on the antioxidant activity of yogurt are presented in Table 1.

Table 1

Antioxidant activity of yogurt samples enriched with mixtures of plant extracts

Sample name	Extract ratio	TEAC, μmol TE/g
Control yogurt	No extract added	50.80
Yogurt + extract mixture	35:35:30	63.00
Yogurt + extract mixture	35:30:35	74.03
Yogurt + extract mixture	40:25:35	71.71

The results showed that the addition of plant extract mixtures increased the antioxidant activity of yogurt. The TEAC value of the control sample was 50.80 μmol TE/g. In the experimental samples containing sweet clover, St. John's wort and purslane extracts, this indicator ranged from 63.00 to 74.03 μmol TE/g.

The yogurt sample containing the extract mixture at a ratio of 35:35:30 had a TEAC value of 63.00 μmol TE/g, which was higher than that of the control sample. In the sample with the 40:25:35 ratio, antioxidant activity reached 71.71 μmol TE/g.

The highest result was observed in yogurt enriched with the mixture of sweet clover, St. John's wort and purslane extracts at a ratio of 35:30:35. In this sample, the TEAC value was 74.03 μmol TE/g. Compared with the control sample, antioxidant activity increased by approximately 45.7%. This result indicates that the studied plant extract mixture can improve the functional properties of yogurt.

The increase in antioxidant activity may be associated with the presence of phenolic compounds, flavonoids and other biologically active substances in the plant extracts. Therefore, the use of a mixture of sweet clover, St. John's wort and purslane extracts in yogurt production can be considered a promising direction for the development of functional dairy products [10].

Conclusion

The results of the study showed that the use of a mixture of sweet clover, St. John's wort and purslane extracts in yogurt production increases the antioxidant activity of the product. Compared with the control sample without extracts, all experimental samples had higher TEAC values.

The highest antioxidant activity was determined in yogurt enriched with the extract mixture at a ratio of 35:30:35. In this sample, the TEAC value was 74.03 μmol TE/g, which was approximately 45.7% higher than that of the control sample.

The obtained results confirm the possibility of using plant extract mixtures as effective natural functional additives for yogurt enrichment. The mixture based on sweet clover, St. John's wort and purslane extracts can improve the functional properties of yogurt and contribute to the development of new dairy products with high antioxidant potential.

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THE IMPACT OF ARTIFICIAL INTELLIGENCE TECHNOLOGY ON SOCIAL STRUCTURES, AND MODERN LIVES

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Abstract

Artificial intelligence (AI) is a rapidly evolving technology with profound impacts today. In recent years, AI systems have become increasingly widespread in many areas, from healthcare to finance, transportation to entertainment. It is clear that these technological advancements have profound effects on social structures. From a sociological perspective, artificial intelligence is not only a technological advancement but also a catalyst for social change. With the integration of AI into daily life, social relations, norms, and institutions have the potential to be reshaped. Therefore, understanding the complex interplay between artificial intelligence and social transformation is vital to dealing with the challenges and opportunities presented by this technological revolution.

Keywords: Artificial intelligence (AI), daily life, activity, technology, revolution

Artificial intelligence (AI), in a broad sense, is a field that enables computer systems, especially machines, to exhibit intelligence. In this field, methods and software are developed and studied that enable machines to perceive their environment and use learning and intelligence to achieve predetermined goals. Artificial intelligence encompasses research in computer science aimed at enabling machines to perform complex tasks. This research focuses on developing various algorithms and techniques to enable machines to exhibit human-like intelligence and behavior (Russell & Norvig, 2021, pp. 1-4). Such machines can be called artificial intelligence. Artificial intelligence (AI) is a technology designed to enable computer systems to exhibit human-like intelligence and abilities.

Artificial intelligence technology is widely used in industry, government, and science. Some notable applications include advanced web search engines (e.g., Google Search); recommendation systems (those used by YouTube, Amazon, and Netflix); interaction with human speech (e.g., Google Assistant, Siri, Copilot, and Alexa); autonomous vehicles (e.g., Waymo); productive and creative tools (e.g., ChatGPT and AI Art); and superhuman gameplay and analysis in strategy games (e.g., Chess and Go). Yet many AI applications are not often classified as AI. Much cutting-edge AI has been filtered into general applications and is often not called AI. This is because once something becomes useful and widespread enough, it is no longer labeled as AI (Kaplan and Haenlein, 2019, pp. 15-25). Alan Turing was the first to conduct significant research in the field he called machine intelligence (Copeland, 2004, p. 8). Artificial intelligence was established as an academic discipline in 1956. The field has gone through many cycles of optimism, followed by periods of disappointment and funding loss known as the AI winter.

After 2012, when deep learning surpassed all previous AI techniques, and after 2017 with transformer architecture, funding and interest increased significantly. This led to the AI explosion in the early 2020s; the vast majority of companies, universities, and laboratories were located in the US, leading to significant advancements in AI (Frank, 2023, pp. 1-2). The increasing use of AI in the 21st century is leading to societal and economic changes such as increased automation, data-driven decision-making, and the integration of AI systems into various economic sectors and areas of life. This affects job markets, healthcare, government, industry, and education. Questions have arisen about the long-term impacts, ethical consequences, and risks of AI technology, triggering debates about regulatory policies to ensure the safety and benefits of the technology. Various subfields of AI research focus on specific goals and the use of specialized tools. Traditional artificial intelligence research's core objectives include reasoning, information representation, planning, learning, natural language processing, perception, and robotic assistance.

Artificial intelligence (AI) has revolutionized technology in recent years and profoundly impacted societal structures. This technology has permeated every aspect of our lives, causing significant changes at the social, economic, and cultural levels. *Firstly*, in the business world, AI is used to increase automation and efficiency. AI-powered robots and software can perform routine tasks faster and more accurately than humans. As a result, changes are seen in the labor market as some jobs are done by machines instead of humans. The disappearance or transformation of certain professions can increase unemployment and the need for retraining. *Secondly*, in the healthcare sector, AI is used to improve diagnostic and treatment processes. AI-powered algorithms can identify diseases earlier and more accurately by examining medical images. This contributes to more effective treatment processes and makes healthcare services more accessible.

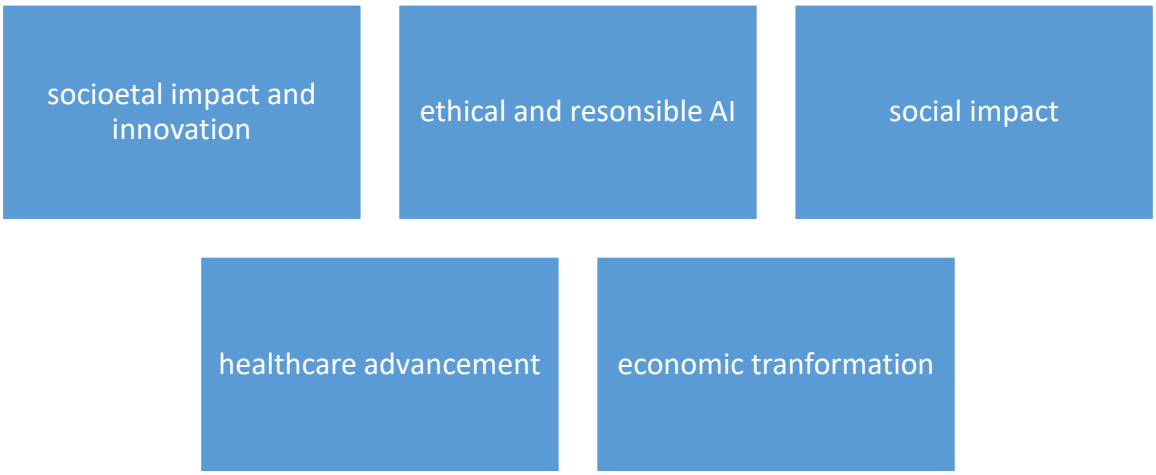
Thirdly, in the area of communication and social interaction, AI impacts societal structures by offering personalized experiences. Social media platforms and digital assistants enhance interactions by recommending content based on users' preferences. However, this personalization can also create an information bubble and prevent people from being exposed to different perspectives. *Fourthly,* security and privacy issues consti-

tute a significant area where AI impacts societal structures. AI can raise concerns about the analysis and use of personal data, leading to new risks such as cyberattacks, data breaches, and ethical debates. The impact of AI on justice and equality is significant. Algorithmic decision-making systems can lead to bias and discrimination or deepen existing inequalities. Therefore, adherence to ethical standards and diversity principles is necessary in the design and implementation of AI systems. The way AI impacts societal structures depends on how the technology is used and managed.

It is explained how artificial intelligence is part of what is called the 'Fourth Industrial Revolution' and which culminates in 'Society 5.0': a digital society where new generation technologies are beginning to play a fundamental role in human existence. The rise of artificial intelligence is often seen as part of the 'fourth industrial revolution'. Following the invention of the steam engine in the first revolution, the second revolution brought mass production, and the third revolution brought computerization. In the current fourth revolution, this information technology has become physical: in the age of digitalization, the internet has become the internet of things, and a computer can have the body of a robot. AI-powered digital technology is intertwined with all aspects of society, and it is becoming increasingly clear that a new society is emerging. In Japan, the type of society that has emerged from this fourth revolution is now called "Society 5.0". From this perspective, the plow led to the transition from hunter-gatherer society to agricultural society, the steam engine to industrial society, and the computer to information society. The fourth revolution has now given way to the fifth type of society:

In Japan, the digital society, also called the "super-intelligent society," has emerged. Artificial intelligence allows computers to do things that were previously only possible for humans.

What are the goals of artificial intelligence? – According to literature review the main goals were presented in the following picture.



Picture 1. Goals of AI

Artificial intelligence is highly likely to have a major impact on our society. And dealing with this impact is not always easy because existing frameworks are being broken down. Until now, we have seen technology as 'passive' and humans as 'active', but artificial intelligence has a form of technological 'autonomy'. Computer systems can 'learn' and as a result can evolve in ways their programmers can never predict and are in a position to make independent decisions and advise people on matters where human thought is not as equipped to control as a computer with artificial intelligence (Future Learn, 2024).

In conclusion the main impacts of AI in modern life were summarized:

- Smartphones;
- Security and surveillances;
- Social media platforms;
- E-commerce;
- Navigation;
- Banking and finance sector;
- Autonomous vehicles;
- Smart homes.

The role and transformation of artificial intelligence in social relationships reflects a complex reality of modern society. The effects of AI are felt across a wide spectrum, from communication and emotional connections to personal interactions and the transformation of social structures. Let's first focus on the role of AI in social relationships. AI is increasingly used in social media platforms, digital assistants, and communication applications. Social media platforms use AI algorithms to analyze user behavior to offer content recommendations, target advertisements, and even predict emotional states. This can affect users' content consumption habits and change the nature of social relationships. For example, if a user ignores a particular piece of content, the algorithm may take this into ac-

count when determining future content recommendations, which can affect how much exposure the user has to others. However, the role of AI in social relationships is not limited to digital environments. AI-based systems such as digital assistants and chatbots attempt to simulate social skills by interacting with users. For example, a digital assistant could use natural language processing and machine learning techniques to answer users' questions and engage in conversation. This allows artificial intelligence to function as a mediator in social relationships and act like a friend or advisor alongside users.

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PROSPECTS OF APPLICATION OF PLANT EXTRACTS OF HYPERICUM PERFORATUM, MELILOTUS ALBUS AND PORTULACA OLERACEA IN THE FOOD INDUSTRY

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Abstract

Currently, one of the priorities for the development of food biotechnology and nutritionology is the search for natural sources of biologically active substances capable of increasing the functional value of food and having a positive impact on human health. Special attention is paid to vegetable raw materials containing a wide range of antioxidant compounds that can neutralize free radicals, reduce oxidative stress and prevent the development of a number of chronic diseases. Among the promising plants with high biological activity, Hypericum perforatum (St. John's wort), Melilotus albus (white sweet clover) and Portulaca oleracea (garden purslane) are of particular interest.

Keywords: 1 Antioxidant activity, 2 secondary metabolites, 3 Hypericum perforatum, 4 Melilotus albus, 5 Portulaca oleracea, 6 plant extracts, 7 functional foods, 8 biologically active substances, 9 plant tissue culture.

The antioxidant activity of these plants is due to the presence of a complex of secondary metabolites, including phenolic compounds, flavonoids, organic acids, vitamins, and other biologically active substances. These compounds play an important role in the protective mechanisms of plants and are at the same time valuable components for the creation of functional foods, biologically active additives and pharmaceuticals [1-2].

Hypericum perforatum is one of the most studied medicinal plants rich in flavonoids, phenolic acids and other antioxidant substances. The plant contains rutin, quercetin, chlorogenic and caffeic acids, which have a pronounced ability to inhibit the processes of lipid peroxidation and neutralize reactive oxygen species. Due to the high content of antioxidants, St. John's wort extracts can be used as natural components of functional foods aimed at increasing the body's resistance to adverse environmental factors [3-4-5].

Melilotus albus is of interest as a source of coumarins, flavonoids, and phenolic compounds with antioxidant and anti-inflammatory properties. Biologically active substances of sweet clover are able to participate in the regulation of redox processes, reducing the damaging effect of free radicals on cellular structures. In addition, the presence of organic acids and minerals increases the nutritional value of plant raw materials and expands the possibilities of its use in functional food technologies [6-7].

Portulaca oleracea is characterized by a high content of vitamins, phenolic compounds, carotenoids and mineral elements. Of particular value are ascorbic acid, flavonoids and other antioxidant components that help protect cells from oxidative damage. Due to its unique chemical composition, purslane is considered as a promising source of natural antioxidants for food enrichment and the creation of new types of functional nutrition [8-9-10].

Modern biotechnological methods make it possible to obtain plant raw materials not only from natural populations, but also using in vitro culture of plant tissues and cells. This approach ensures year-round biomass production, stability of the qualitative composition and the possibility of targeted regulation of the synthesis of secondary metabolites. The use of in vitro cultivation technologies for Hypericum perforatum, Melilotus albus and Portulaca oleracea opens up prospects for obtaining standardized sources of antioxidants regardless of climatic and seasonal factors. The practical application of extracts of the studied plants is primarily associated with the development of functional food products of a new generation. The inclusion of plant extracts in the composition of fermented milk products helps to increase their antioxidant activity, improve nutritional value and expand the range of physiologically significant properties. An additional advantage is the possibility of using natural antioxidants as an alternative to synthetic supplements, which corresponds to current trends in the development of the healthy nutrition industry [11-12-13].

Thus, Hypericum perforatum, Melilotus albus and Portulaca oleracea are promising sources of natural antioxidants with high potential for practical applications in the food industry, pharmaceuticals and biotechnology. The use of extracts of these plants contributes to the creation of functional products with increased biological value and preventive focus. Further research should be aimed at optimizing the methods of obtaining plant raw materials, studying the mechanisms of antioxidant action of biologically active compounds and developing innovative technologies for their use in food production. This work is part of project The research was carried out within the framework of the grant funding project Irn AR23489321 "Development of technology for functional dairy products obtained using secondary metabolites of plant raw materials grown in vitro"

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